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MOREHEAD & STANTON

RANGER DISTRICTS

DANIEL BOONE *National Forest* KENTUCKY

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SOIL MANAGEMENT REPORT

MOREHEAD AND STANTON RANGER DISTRICTS

DANIEL BOONE NATIONAL FOREST

KENTUCKY

U. S. DEPARTMENT OF AGRICULTURE

FOREST SERVICE

REGION 8

1969

FOR IN-SERVICE USE

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INTRODUCTION

The soil survey of the Morehead and Stanton Ranger Districts of the Daniel Boone National Forest is part of the National Cooperative Soil Survey of the United States. It was made jointly by the Forest Service and Soil Conservation Service in cooperation with the Kentucky Agricultural Experiment Station. Field work began in July 1966 and was completed November 1969.

This In-Service Soil Management Report has been assembled by the Soils Project with the assistance of district personnel and staff specialists to aid in the effective use of soil information in multiple use land management. Management interpretations contained in this report reflect trends at this time and are not considered as final. As additional knowledge is gained by field experience on the districts and by research, these initial interpretations should be refined and reorganized.

How To Use The Soil Management Report

This report is divided into three parts. Part I contains information about the geology, geomorphology, drainage, climate, and vegetation of the area. Part II describes the individual soils and their important features. Part III has specific soil interpretations by multiple use function and for special uses.

The aerial photographic soil map reproductions are filed at the Ranger District Offices and at the Supervisors Office. Accompanying the soil maps are county maps showing the approximate location of each soil map and its index number. Locate the area of interest using the county index map or the index sheet at the back of this report. Refer to the appropriate soil map by the listed index number. On the soil map locate the specific area and soil symbol (a number and letter symbol). Then refer to the table "List of Mapping Unit Symbols and Names with Functional Management Groups" at the end of this report which lists soil symbols numerically and gives soil names and functional management group numbers for each function or special use. These numbers refer to the appropriate interpretive management groups for specific information in each interpretive section. After selecting the appropriate interpretive group number for the particular soil symbol and function or special use in question, refer to the appropriate section in part III of this report for the desired information.

PART I - THE LANDSCAPE

A. Geology

See accompanying chart this section and refer to Part III section A for soil-geology-landscape relationships illustrated on diagrams and a map. The area is in the Mountains and Eastern Coalfields physiographic region and is underlain by different layers of sedimentary rocks that dip gently to the southeast. They were part of a once great depression known as the Appalachian Geosyncline that filled with sand, silt and clay washed in from the uplands, and with animal shell and plant deposits. The sand, silt and clay cemented and formed alternating layers of sandstones, siltstones and shales. The interlayered deposits of animal shells fused into limestone and thick plant deposits developed into coal. Then a gradual uplift of the rocks known as the Cincinnati Arch began. The resultant erosion, weathering and valley cutting by streams over a long period of time created our present maturely dissected plateau and exposed many of the different horizontally bedded layers of rocks.

There are four different aged rocks exposed in the survey area and listed in chronological order from the youngest to the oldest: Pennsylvanian, Mississippian, Devonian, and Silurian.

The Pennsylvanian aged rocks cover most of Lee, Wolfe and Morgan Counties except for some deep valleys near the western parts of the counties; cap ridges and upper slopes in the eastern half of Menifee, Powell, Estill, and Rowan Counties; and caps a few ridges in the far eastern part of Bath County. These rocks are acid sandstones, shales and some siltstones in alternating layers. The sandstone strata are fine to coarse grained and the thick Rockcastle Sandstone is conglomeratic. The Rockcastle sandstone is in the Lee Formation and in some places is the oldest Pennsylvanian aged rock. It forms a giant cliff down through the middle of the survey area known as the Pottsville Escarpment. A thin layer of Beattyville shales is below the Rockcastle Conglomerate in most places and is generally the strata that divides the Pennsylvanian aged from the Mississippian aged formations. Soils formed from Pennsylvanian aged rocks are generally very strongly acid with low fertility. Textures range from sandy loam to clay.

The Mississippian aged rocks cover most of Estill, Powell, Rowan, Bath, and Menifee Counties and the deep valleys on the western edge of Morgan, Wolfe and Lee Counties. These rocks are mostly evenly bedded acid siltstones with shale and limestone partings. Some shales and siltstones are calcareous and some are argillicaceous. The upper part of the Mississippian layers is largely limestone which forms a discontinuous cliff in many places and caps ridges. The limestone formations generally produce clayey soils with high reaction and fertility levels. The siltstones and shales generally produce gravelly silt loam soils that are very strongly acid with low fertility.

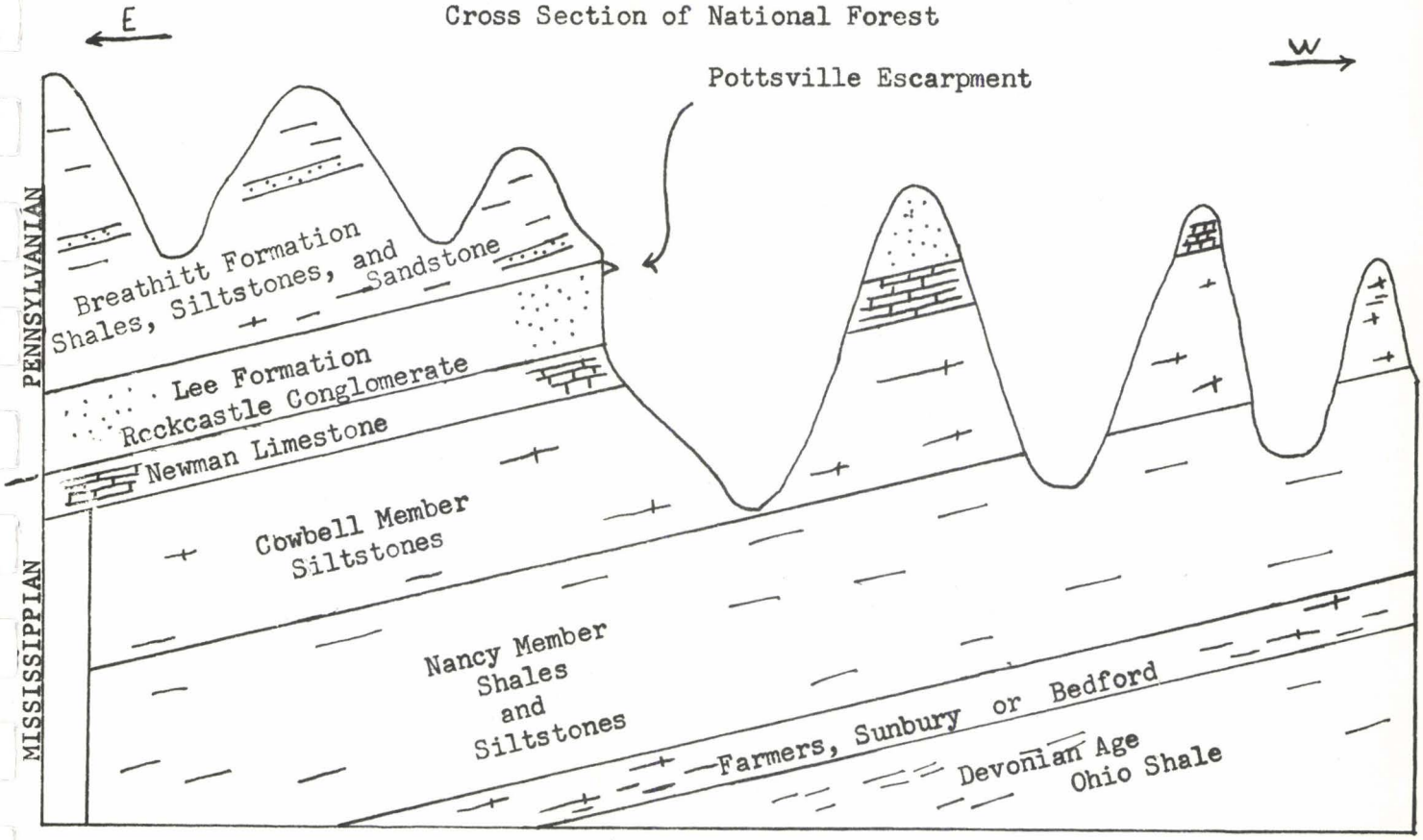
The Devonian and Silurian aged rocks outcrop in the western edge of Estill, Powell and Rowan Counties and in Bath County. The Devonian rocks are black, highly carbonaceous shale with some thin sandstone and calcareous layers in the upper part. The Silurian rocks are bluish-gray and green, clay shale with thin beds of dolomitic limestone. The soils developed from Devonian and Silurian rocks are generally clayey, strongly acid and have medium fertility.

The kind of surface rock greatly influences the kind of soil that develops, particularly in residual soils. In general, the shale rocks are soft and easily weathered into moderately deep to deep, clayey soils. Sandstones are resistant and tend to form shallow, sandy soils. Siltstones are also resistant and tend to form shallow, silty soils high in coarse fragments. Limestones form soils very high in clay that are very sticky and very plastic in consistence. Soils developed in colluvium from two or more kinds of rock exhibit characteristics from the combination. The deep soils on the mountainsides have developed in colluvium washed from soils and rocks on the ridges and upper slopes. Except for an occasional outcrop the deep colluvium disguises the surface geology.

Assistance in naming and illustrating sections was provided by John Philley, Geology Department, Morehead State University.

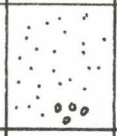
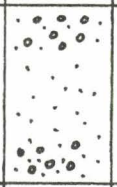
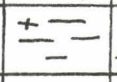
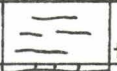
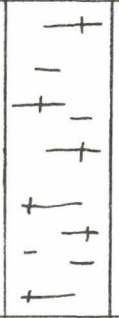
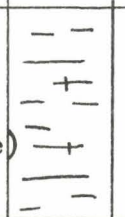
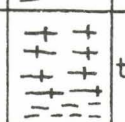
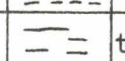
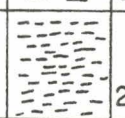
Chart 1

SIMPLIFIED STRUCTURAL GEOLOGY
Cross Section of National Forest



GENERALIZED STRATIGRAPHIC CROSS SECTION OF
EXPOSED GEOLOGY AND RELATED SOILS IN THE SURVEY AREA

Chart 2

System	Series	Formation And Member	Lithology	Thick feet	Brief Description	Related Soils
Quaternary	Recent	Alluvium and Valley fill		2 to 50	Mixtures of sand, silt, clay and or gravel.	Bonnie, Johnsburg, Stendal, Pope, Chavies, Whitley, Morehead, Cotaco, Clifty, etc.
PENNSYLVANIAN	Middle	Breathitt Formation		100 to 200	Hard and soft acid shales; siltstones; some sandstone and coal.	Wharton, Shelocta, Gilpin, Whitley, Tilsit, Jefferson, Hartsells.
	Lower	Sandstone Member (Rockcastle)		100 to 500	Massive quartzose sandstone. Some conglomerate layers, particularly in lower part. Cliff former.	Dekalb, Ramsey, Hartsells, Jefferson.
		Shale Member		0 to 80	Gray to black shales, silty shales and slst.	Wharton, Shelocta. (Some fire clay)
MISSISSIPPIAN	Upper	Pennington Formation		0 to 40	Multicolored shale, calcareous.	Wharton, Talbott.
		Newman Limestone Formation		0 to 200±	Limestones of variable character. Some calcareous shales.	Talbott, Brookside, Caneyville, Wharton.
	Lower	Borden Formation — Renfro Member		0 to 50	Yellow dolomitic limestone.	Talbott, Brookside.
		Borden Formation — Nada Member		0 to 40	Red and maroon shale. Some calcareous.	Wharton
		Borden Formation — Cowbell Member (Brodhead)		200 to 300	Mainly a massive siltstone. Some shale and limestone partings.	Berks, Gilpin, Cranston.
		Borden Formation — Nancy Member (New Providence)		100 to 200	Siltstone and argillaceous to silty shales.	Cranston, Gilpin, Shelocta, Berks, Wharton, Whitley.
		Borden Formation — Farmers Member		0 to 50	Evenly bedded siltstone with argillaceous shale near base.	Berks, Wharton.
		Sunbury Form.		0 to 20	Black fissile shales.	Trappist, Muse.
Devon.	Upper	Ohio Shale Formation		50 to 200+	Black fissile shales.	
Silur.	Low Mid	Crab Orchard Formation		0 to 40+	Soft clay shale. Some limestone layers.	Muse, Wharton.

B. Geomorphology

The survey area consists of a maturely dissected plateau with variable relief creating a range of low mountains. Generally, narrow winding ridges, steep valley walls and narrow bottoms characterize the area. Most soils on the sideslopes have developed in colluvium of variable thickness overlying alternating layers of resistant and non-resistant rocks. This generally creates complex, benchy or dissected sideslopes. The youthful alluvium of the flat valley bottoms is held up by resistant rocks. Soils on ridgetops have developed in the residual rocks.

Elevations vary from 6-700 feet along major rivers to 13-1400 feet on mountain tops. The average elevation of the plateau ridgetops is about 1100 feet with most streams running at about 800 feet.

The survey area is in the Licking River, Red River and Kentucky River watersheds. The rivers run in a westerly or northwesterly direction through the area and the large tributary streams generally run northeast or southeast. A multitude of lesser streams, and branches connect with the large tributaries and the rivers. The dendritic stream pattern is largely a result of the shale and siltstone strata which predominates in the survey area.

The Pottsville Escarpment runs northeast-southwest through the middle of the survey area and creates a belt of rugged topography. This area is characterized by a large sandstone cliff on the upper part of the hillside. Steep stony slopes are below the cliff. The streams have rather large watershedswith narrow bottoms and terraces. Most streams have running water year around. In this area the ridges are generally broad and flat with the sideslopes above the cliff short and rounded.

In much of the survey area west of the Pottsville Escarpment the valleys are flat and broad with steep dissected lower hillsides. The streams are often nearly dry, but flashy in the summer months and they have relatively small stream beds. However, the streams have fairly large watersheds and broad floodplains and terraces. Ridges are rounded and narrow.

Much of the survey area east of the Pottsville Escarpment consists of rounded, wide ridges and steep short sideslopes. There are several broad valley bottoms along the major rivers and large tributaries, but most valleys are narrow and V-shaped. The drainage pattern is highly dendritic with more branches than the western part of the survey area.

C. Drainage

The dendritic drainage system in the area consists of several rivers and long streams with perennially running water and numerous short streams and branches with intermittent water flow. The rivers and long streams, which are 5 to 15 miles in length within the survey area, have developed moderately wide to wide bottoms and terraces with poorly to well drained soils. Most ridges are narrow, well to excessively drained and generally are droughty. Some ridges are wide with deep soils that retain moisture. Sideslopes have well drained soils, are steep and are dissected with many short branches.

On their dissecting routes to larger streams, the short intermittent branches often form alluvial fans that protrude into the bottoms or terraces. Some branches lack a stream channel which prevents good drainage and generally creates wet soils with seeps on the fans and nearby bottom soils. Most of the soils on high terraces in the area have fragipans and are not well drained. Ponding of water on the surface and seeps are common in these areas. Generally these are good places to build ponds and develop wildlife clearings.

Peak flows generally occur in late winter and early spring when the soils are saturated and rainfall is more abundant. However, thunderstorms can cause short-duration high-intensity rainfall in the summer months and floods can occur.

Springs and seeps commonly occur at the base of sandstone cliffs and in limestone formations. Some springs or seeps are on sloping to moderately steep colluvial toeslopes that grade into nearly level terraces that have soils with fragipans. In these instances, the soils on the toeslopes are not well drained.

D. Climate [1/]

The climate is temperate, with moderately cold winters and warm humid summers. Temperature, rainfall and humidity remain within limits agreeable to man and are suitable for varied plant and animal life. All seasons are marked by weather changes that come from passing weather fronts and associated centers of high and low pressure. This activity is least in the late spring and summer months, somewhat greater in the fall, and greatest in the winter and early spring. Temperatures depart least from the average during the period of minimum activity and vary from the average most during the period of greatest activity.

Precipitation is fairly well distributed throughout the year, with no wet season and no dry season. The month of October has the least rainfall. Annual free-water evaporation, i.e., from shallow lakes and farm ponds, averages about 35 inches, about 11 inches less than the average annual precipitation. About 74 percent of this evaporation occurs during the 6-month period of May-October.

A statistical study of heavy precipitation in just a few hours in this area indicates the probability of occurrence of totals at least as great as those listed below:

Frequency in 100 years	Inches in 1 hour	6 hours	12 hours
1	2.8	4.3	5.2
4	2.3	3.6	4.2
20	1.7	2.7	3.2
100	1.1	1.9	2.2

Snowfall is quite variable from year to year. Some winters have relatively little. The greatest annual total recorded for the period of this summary was 44.9 inches, in 1960; the least recorded, 3.6 inches, was in 1949. Thunderstorms occur on an average of about 46 days each year. They are most frequent in the spring and summer months but can occur in any month. They cause most of the short duration high intensity type of rainfall indicated in the preceding table.

The growing season (defined as the number of days between the last spring and the first fall temperature of 32°) averages 166 days. The season is 187 days or more in 10 percent of the years, 177 days or more in 25 percent of the years, less than 155 days in 25 percent of the years, and less than 145 days in 10 percent of the years.

This area has a favorable and moderate climate, with many of the days of the year being nearly ideal in temperature. The fall season has many mild, sunny days and is considered one of the better times of the year for outdoor activities.

1/ Allen B. Elam, Jr. Weather Bureau State Climatologist. University of Kentucky, Lexington, Kentucky.

CHART 3

CLIMATOLOGICAL SUMMARY

Latitude 38° 09' N
Longitude 83° 33' W
Elev. (Ground) 662 feet

Station FARMERS, KENTUCKY

Means and Extremes for Period 1931 - 1960

Month	Temperature (°F)							**	Precipitation Totals (Inches)								Mean Number of Days					Month
	Means			Extremes								Snow, Sleet						Temperatures				
																		Max.		Min.		
	Daily maximum	Daily minimum	Monthly	Record highest	Year	Record lowest	Year	Mean degree days	Mean	Greatest daily	Year	Mean	Maximum monthly	Year	Greatest daily	Year	Precip. .10 inch or more	90° and above	32° and below	32° and below	0° and below	
(a)	30	30	%	26		26		%	30	30		22	22¢		22¢		30	26	26	26	26	
Jan.	47.1	25.4	36.3	80	1943	-20	1936	890	4.45	2.95	1945	4.1	13.8	1948	7.5	1936	8	0	4	22	1	Jan.
Feb.	49.6	26.0	37.8	81	1932	-19	1934	762	3.63	2.61	1945	4.1	23.5	1960	7.5	1951	7	0	2	20	1	Feb.
Mar.	57.6	32.0	44.9	88	1945	9	1960	632	4.63	2.79	1955	2.3	17.8	1960	6.3	1947	8	0	1	18	*	Mar.
Apr.	69.4	41.4	55.4	93	1942	17	1950	297	3.87	2.52	1948	T	1.0	1944	1.0	1944	8	*	0	6	0	Apr.
May	78.8	50.2	64.5	97	1931	26	1947	105	4.06	2.20	1943	0	0		0		8	1	0	1	0	May
June	85.8	58.9	72.4	104	1936	37	1948	9	4.49	2.60	1950	0	0		0		8	10	0	0	0	June
July	88.7	62.7	75.7	105	1954+	43	1947	0	4.79	3.74	1938	0	0		0		8	14	0	0	0	July
Aug.	87.5	61.1	74.2	106	1936	40	1945	6	4.11	3.28	1945	0	0		0		7	12	0	0	0	Aug.
Sept.	82.5	53.7	68.1	103	1932	29	1942+	63	3.08	2.64	1942		0		0		5	5	0	*	0	Sept.
Oct.	71.9	42.0	57.0	94	1953	16	1952	264	2.26	1.77	1939	T	T	1957	T	1957	5	*	0	6	0	Oct.
Nov.	58.1	32.0	45.1	85	1948	0	1950	597	3.21	3.20	1936	1.3	8.8	1950	4.0	1950	7	0	*	17	*	Nov.
Dec.	47.9	26.4	37.2	74	1951	-14	1935	862	3.23	2.63	1942	2.9	11.6	1945	6.0	1945	7	0	3	22	1	Dec.
Year	68.7	42.7	55.7	106	Aug. 1936	-20	Jan. 1936	4487	45.81	3.74	July 1938	14.7	23.5	Feb. 1960	7.5	Feb. 1951+	86	42	10	112	3	Year

(a) Average length of record, years.

T Trace, an amount too small to measure.

** Base 65°F Climatography of the United States No. 83-13, Kentucky.

% Normals, based on 1931-1960 data.

\+ Also on earlier dates, months, or years.

* Less than one half.

¢ 22 complete years, and 8 years with one or more months of record missing.

E. Vegetation

The native vegetation in the survey area was predominately deciduous trees, mainly oaks, tulip poplar and hickories. Virginia, shortleaf and pitch pines were common near cliffs and on narrow droughty ridges. Past logging practices, disease and fires have altered the native vegetation but several major cover types can be discerned in the area.

The pine-oak cover type is largely shortleaf pine with Virginia pine, pitch pine, white, chestnut, black, and scarlet oaks, pignut and mockernut hickories, and black gum as associates. Common understory species are sourwood, sassafras, and dogwood. Forbs or ground vegetation consists of blueberries, mountain laurel, greenbrier, grape, bracken fern, beggars lice and false solomon seal. This xeric type occurs on narrow to broad ridges and upper side slopes with a southerly aspect.

The oak-hickory cover type consists predominately of scarlet, black, white and chestnut oaks and hickories with an occasional black gum, Virginia and shortleaf pine. Understory species usually present are black gum, sourwood, dogwood, sassafras, red maple, shadbush, beech, and some tulip-poplar. The ground vegetation consists of greenbrier, sassafras, blueberry, foxglove, grass, beggars lice, poison ivy and some Christmas fern. This type occupies steep sideslopes with southerly aspects and ridgetops.

The oak type is similar to the oak-hickory type but occurs on the less dry sites. Some southern and northern red oak, ash and tulip-poplar are in this type. Occasionally this type forms a pure white oak stand. The shrub and ground vegetation layers are more dense than the oak-hickory type.

The oak-tulip poplar cover type is largely tulip poplar, white oak and black oak. Other associates are scarlet and red oaks, shagbark hickory, hemlock, white pine, beech, ash and black gum. The understory consists of sugar maple, beech, buckeye, elm, cucumber tree and basswood. Common shrubs are dogwood, paw paw, red bud, oaks, beech, spice bush, sugar maple, and red maple. The ground vegetation consists of many ferns, ginger, solomon seal, beggars lice, wild sweet potato, wild geranium and Virginia creeper. This type is on steep sideslopes with northerly aspects and along drainageways and is subclimax or climax.

The cove hardwood type is in steep coves and slopes below large cliffs and usually on northerly aspects. The mesic sites are moist and often medium to high in fertility. This climax type is largely hemlock, white pine, northern red oak, beech, tulip poplar and white oak. Other common associates are basswood, cucumber, walnut, ash, Ohio buckeye, sugar maple and shagbark hickory. The understory includes big-leaf magnolia, black birch and shadbush. The shrub layer has hydrangea, spice bush, black cherry, elm, redbud, dogwood and sugar maple. The ground vegetation has many moist site species such as rattlesnake root, maidenhair fern, Christmas fern, walking fern, ginger, hepatica, bell wort, blood root, coral bells, jack-in-the-pulpit, and dogtooth violet.

PART II DESCRIPTIONS OF THE SOILS

Each soil series that is in the survey area is described on the following pages. Each description shows the map symbol and the mapping unit or soil phase name that was used in surveying each soil series. The profile of each soil is described showing the horizon thickness, color, texture, structure, etc. A few of the important features about each series are listed at the bottom of each profile description.

This section is designed to give individuals detailed information on the different soil series as the soils occur on the landscape. This information is particularly useful to foresters, watershed scientists, engineers and other specialists that require detailed information on the actual physical characteristics of the different soils. Part III, Soil Use and Management, gives interpretations on the use of soils and this section, Description of Soils, shows what the soil is and what it looks like. The soil profile, as given here, is the basis of much of the soil scientist's work. The soil profiles are used to classify the soils, to study and compare soils, and to make interpretations about the use of the soils.

SOIL DESCRIPTIONS AND SOIL CLASSIFICATION

Describing soil profiles and classifying the soils into the National System of Soil Classification is an important aspect of the Soil Scientists work. Proper soil classification is mandatory for the development of precise interpretations of the soils for different uses in forest land management.

Forest Service and Soil Conservation Service Soil Scientists are examining and classifying a forested soil in the photo above. From left is P. M. Love, S.C.S.; T. W. Green, Regional Soil Scientist, U.S.F.S.; R. E. Daniell State Soil Scientist, Ky. S.C.S.; and P. E. Avers, U.S.F.S. The classification of forested soils in the Appalachian Mountains has improved considerably since the Forest Service began their soil mapping program in the mountains 10 years ago.

SOIL SCIENTISTS PREPARE SITE

In order to classify a soil correctly, soil pits must be dug. In the photo above soil scientists are preparing a site to record soil data. The data includes a profile description, soil samples to be analyzed and other landform and vegetation information necessary for classifying and interpreting the soil. From left is T. W. Green, J. S. Austin, P. M. Love and R. E. Daniell.

ALLEGHENY SERIES

Map Symbol	Soil Phase Name
376B1	Allegheny loam, 2 to 6 percent slopes.
376C1	Allegheny loam, 6 to 12 percent slopes.
376D1	Allegheny loam, 12 to 20 percent slopes.

The Allegheny series consists of deep, well drained soils that have developed in old alluvium and colluvium on high terraces or toeslopes.

Representative Profile

Horizon	Depth	Horizon Description
Ap	0 to 7"	Brown loam; fine granular structure; very friable; very strongly acid.
B1	7 to 18"	Yellowish brown loam; fine and medium subangular blocky structure; very friable; very strongly acid.
B21t	18 to 31"	Strong brown sandy clay loam; fine and medium subangular blocky structure; friable; few clay films; very strongly acid.
B22t	31 to 41"	Strong brown clay loam; medium angular blocky structure; firm; many clay films; very strongly acid.
B3	41 to 60"	Strong brown loam; coarse angular blocky structure; friable; few clay films; very strongly acid.
C	60 to 90"+	Yellowish brown fine sandy loam; massive; very friable; very strongly acid.

Important Features

Depth to and kind of rock: Ranges from 6 to 12 feet to shale or siltstone.

Runoff and permeability: Surface runoff is low and permeability is moderate.

Erosion hazard: B1 and C1 is moderate, D1 is severe.

Remarks: Except for slope this soil has slight limitations for recreation use. Soil is good for establishing wildlife clearings.

BERKS SERIES

Typical low quality chestnut oak stand on the very steep Berks silt loam. Due to this soils low productivity and severe erosion hazard it should be left in its current vegetative cover for watershed protection and wildlife management. This is an extensive soil in the survey area.

BERKS SERIES

Map Symbol	Soil Phase Name
878G1	Berks silt loam, 50 to 70 percent slopes.

The Berks series consists of moderately deep somewhat excessively drained soils that have developed in siltstone on very steep slopes and narrow ridges.

Representative Profile

Horizon	Depth	Horizon Description
O1	½ to 0"	leaves and twigs.
A1	0 to 3"	Dark grayish-brown silt loam; granular structure; very friable; 10 percent siltstone fragments; extremely acid.
B1	3 to 11"	Pale brown gravelly silt loam; subangular blocky structure; very friable; 15 percent fragments; very strongly acid.
B2	11 to 24"	Light yellowish brown gravelly silt loam; subangular blocky structure; very friable; 50 percent fragments; common pores; very strongly acid.
C	24 to 32"	Light yellowish brown gravelly silt loam; granular structure; very friable; 65 percent fragments; common pores; very strongly acid.
R	32"	Siltstone bedrock; fractured with some roots and films of soil material between the layered beds of siltstone.

Important Features

Depth to and kind of rock: Ranges from 20 to 36", siltstone.

Runoff and permeability: Rapid surface runoff and moderately rapid permeability.

Erosion: Very severe hazard.

Remarks: Soil has severe limitations for all phases of forest management. The recommendation is permanent forest for watershed protection and wildlife management.

BONNIE SERIES

Map Symbol	Soil Phase Name
191	Bonnie silt loam, 0 to 2 percent slopes.

The Bonnie series consists of deep, poorly drained soils that have developed in alluvium on flood plains. The landform generally is a depression.

Representative Profile

Horizon	Depth	Horizon Description
A1	0 to 3"	Dark grayish brown silt loam; granular structure; very friable; very strongly acid.
B1	3 to 10"	Gray mottled with yellowish red; silt loam; granular structure; friable; very strongly acid.
B2	10 to 28"	Dark gray mottled with dark brown; silt loam; subangular blocky structure; wet and sticky; very strongly acid.
C1	28 to 60"	Dark greenish gray mottled with yellowish brown; silt loam; structureless; wet and sticky; very strongly acid.
C2	60 to 75"	Yellowish brown mottled with gray; silt loam; structureless; wet and sticky; very strongly acid.

Important Features

Depth to and kind of rock: Ranges from 3½ to 8 feet; siltstone.

Runoff and permeability: High surface runoff and moderate permeability above the water table.

Water table: 0 to 1 foot.

Flood Hazard: Severe, usually floods annually.

Remarks: Wetness restricts most forest management practices. Soil is difficult to drain because outlets are scarce. Build up is necessary for intensive use. Internal percolation is slow because of the high water table. Swamp-like areas occur in some places.

CHAVIES SERIES

Map Symbol	Soil Phase Name
380A1	Chavies fine sandy loam, 0 to 2 percent slopes.
380B1	Chavies fine sandy loam, 2 to 6 percent slopes.

The Chavies series consists of deep well drained soils that have developed in sandy alluvium on low terraces.

Representative Profile

Horizon	Depth	Horizon Description
Ap	0 to 9"	Dark brown fine sandy loam; granular structure; very friable; strongly acid.
B1	9 to 15"	Yellowish brown fine sandy loam; fine subangular blocky structure; friable; strongly acid.
B21t	15 to 23"	Dark brown fine sandy loam; medium subangular blocky structure; friable; common clay films and pores; very strongly acid.
B22t	23 to 34"	Strong brown sandy clay loam; fine and medium subangular blocky structure; friable; common clay films and pores; very strongly acid.
B3t	34 to 45"	Strong brown sandy loam; fine subangular blocky structure; friable; few clay films and pores; very strongly acid.
C	45 to 65"	Yellowish brown sandy loam to loam; structureless friable; very strongly acid.

Important Features

Depth to and kind of rock: Ranges from 5 to 20 feet; siltstone.

Water Table: Generally below 4 feet. Seasonally at about 3 feet.

Flood Hazard: Moderate; once or twice in 5 years. Some areas of this soil flood nearly every spring.

Runoff and Permeability: Low runoff and moderately rapid permeability.

Remarks: This soil has a high available moisture capacity and a low compaction hazard. Flood hazard is variable and on site determination is necessary.

CLIFTY SERIES

Profile of Clifty silt loam. Notice the gravelly subsoil that often has 80 to 90 percent gravel content. The gravelly phases of Pope soils are similar to Clifty silt loam except they have textures of fine sandy loam in the fine earth fraction. Except for the flood hazard in some places, these soils are suited to many recreational uses. The rapidly permeable subsoil limits its use for septic tank filter fields, lagoons and ponds. These soils are a good source of gravel. Clifty soils are of moderate extent.

CLIFTY SERIES

Map Symbol	Soil Phase Name
133, 283	Clifty silt loam, 0 to 2 percent slopes.

The Clifty series consists of deep well drained soils that have developed in gravelly alluvium on first bottoms and low terrace positions.

Representative Profile

Horizon	Depth	Horizon Description
Ap	0 to 9"	Dark brown gravelly silt loam; granular structure; very friable; 20 percent gravel; very strongly acid.
B	9 to 18"	Yellowish brown silt loam; subangular blocky structure; very friable; 2 percent gravel; very strongly acid.
C	18 to 50"	Yellowish brown gravelly silt loam; structureless; loose; 90 percent gravel; very strongly acid.
R	50"	Siltstone rock.

Important Features

Depth to and kind of rock: Ranges from 4 to 6 feet; siltstone.

Water Table: Generally below 3 feet, seasonally at or near the surface.

Flood Hazard: Severe; most areas flood annually some areas not so often or not at all.

Texture: Depth to gravel layer varies from 7 to 24 inches. Percent gravel in the C horizon varies from 50 to 100.

Remarks: This soil would seem to be very droughty but because of its landscape position it generally has a moderate moisture supply. However its capacity to retain moisture is low and it becomes droughty without a continuous moisture supply from the uplands. An on-site determination is necessary for the flood hazard. The soil layer over the gravel must be nearly saturated before water will enter the gravel layer.

CRANSTON SERIES

A good young white oak stand on Cranston gravelly silt loam. Notice the road bank showing the deep gravelly soil. This soil is well suited to hardwood production of oaks and yellow-poplar. The gently sloping and sloping phases of this soil are suited to recreational developments and wildlife clearings. This is an extensive soil.

CRANSTON SERIES

Map Symbol	Soil Phase Name
490B1; 40B1	Cranston gravelly silt loam, 2 to 6 percent slopes.
490C1; 40C1	Cranston gravelly silt loam, 6 to 12 percent slopes.
490D1; 40D1, 842D3	Cranston gravelly silt loam, 12 to 20 percent slopes.
490E1; 842E1	Cranston gravelly silt loam, 20 to 30 percent slopes.
490F1; 842F1	Cranston gravelly silt loam, 30 to 60 percent slopes.

The Cranston series consists of deep, well drained soils that have developed in siltstone and shale colluvium on gently sloping to steep slopes.

Representative Profile

Horizon	Depth	Horizon Description
O1	1½ to 0"	Partially decomposed leaves and twigs.
A1	0 to 5"	Dark brown gravelly silt loam, medium granular structure; very friable; 20 percent siltstone fragments; very strongly acid.
B1	5 to 13"	Light yellowish brown gravelly silt loam; fine subangular blocky structure; friable; 25 percent fragments; common pores; very strongly acid.
B2t	13 to 31"	Yellowish brown gravelly silt loam; fine subangular blocky structure; friable; 30 percent fragments; common clay films and pores; very strongly acid.
B3t	31 to 55"	Brown gravelly silt loam; very fine subangular blocky structure; friable; 40 percent fragments; few clay films and common small cavities; very strongly acid.
C	55 to 65"	Brown gravelly silt loam; structureless; firm; 50 percent fragments; very strongly acid.

Important Features

Depth to and kind of rock: Ranges from 4 to 20 feet or more; siltstone or shale.

Runoff and Permeability: Rapid surface runoff on slopes over 20 percent slower on less slopes. Moderately rapid permeability. Available moisture is medium.

Erosion and Soil Stability: 2 to 12 percent slopes - stable and slight erosion hazard. 12 to 60 percent slopes. Severe slump and erosion hazard.

Remarks: Soil tends to be droughty.

COTACO SERIES

Map Symbol	Soil Phase Name
46B1, C1, 47B1	Cotaco loam, 2 to 6 percent slopes.

The Cotaco series consists of deep, somewhat poorly drained soils developed in alluvium and colluvium on fans and toeslopes.

Representative Profile

Horizon	Depth	Horizon Description
Ap	0 to 6"	Dark brown fine sandy loam; medium granular structure; friable; 4 percent gravel; neutral.
B1	6 to 13"	Yellowish brown fine sandy loam with common mottles of light grayish brown; fine subangular blocky structure; 4 percent gravel; neutral.
B2t	13 to 23"	Yellowish brown loam with common mottles of light brownish gray and very pale brown; fine subangular blocky structure; friable; few clay films; 5 percent gravel; neutral.
B3	23 to 35"	Yellowish brown loam with common mottles of dark brown and light gray; fine subangular blocky structure; friable; 10 percent gravel; slightly acid.
C	35 to 50"	Yellowish brown gravelly loam with common mottles of very dark grayish brown and light brownish gray; massive; friable; 25 percent gravel; slightly acid.

Important Features

Depth to and kind of rock; Ranges from 4 to 15 feet to siltstone.

Runoff and Permeability: Surface runoff is medium to low and permeability is moderate.

Erosion Hazard: Slight

Water Table: Seasonally at about 12 inches.

Remarks: Wetness restricts the use of this soil for recreation and roads.

CUBA SERIES

Map Symbol	Soil Phase Name
180	Cuba silt loam, 0 to 2 percent slopes.

The Cuba series consists of deep, well drained soils that have developed in silty alluvium on first bottoms.

Representative Profile

Horizon	Depth	Horizon Description
Ap	0 to 8"	Dark brown silt loam; fine granular structure; very friable; few pores, slightly acid.
B1	8 to 20"	Dark yellowish brown silt loam; fine and medium granular structure; very friable; few pores; slightly acid.
B2	20 to 27"	Olive brown silt loam; fine subangular blocking structure, very friable; common pores; slightly acid.
B3	27 to 44"	Yellowish brown silt loam; fine subangular blocky structure; friable; few pores; very strongly acid.
C	44 to 85"	Yellowish brown silt loam; structureless; friable; very strongly acid.

Important Features

Depth to Rock: Ranges from 4 to 10 feet or more.

Water Table: Generally below 3 feet but seasonally at or near the surface.

Flood Hazard: Severe; most areas of this soil flood annually; some areas not so often.

Available Moisture: High; excellent soil for wildlife clearings and trees.

Remarks: Flooding imposes limitations on the use of this soil for recreation and related functions but otherwise it is well suited.

DEKALB SERIES

Map Symbol	Soil Phase Name
857D1; 836C1, 857C1, 011	Dekalb and Ramsey rocky sandy loams, 6 to 20 percent slopes.
857E1	Dekalb and Ramsey rocky sandy loams, 20 to 40 percent slopes.

(Dekalb soil is mapped with Ramsey soil)

The Dekalb series consists of moderately deep, somewhat excessively drained soils that have developed in sandstone on ridges and steep slopes near sandstone cliffs.

Representative Profile

Horizon	Depth	Horizon Description
O1	1½ to 0	Partially decomposed leaves and twigs.
A1	0 to 2"	Dark grayish brown sandy loam; fine granular structure very friable; very strongly acid.
B1	2 to 10"	Light yellowish brown sandy loam; fine subangular blocky structure; very friable; very strongly acid.
B2	10 to 25"	Yellowish brown sandy loam; fine subangular blocky structure; friable; 2 percent sandstone fragments; very strongly acid.
C	25 to 36"	Light yellowish brown sandy loam; structureless; loose; 5 percent fragments; very strongly acid.
R	36" +	Sandstone bedrock.

Important Features

Depth to and kind of rock: Ranges from 2 to 3½ feet; sandstone.

Runoff and Permeability: Surface runoff is low and permeability is moderately rapid.

Erosion: Moderate hazard on 857D1 and severe on 857E1.

Remarks: This soil has low available moisture for plant growth and is droughty.

ELK SERIES

Map Symbol	Soil Phase Name
379A1; 377A1	Elk silt loam, 0 to 2 percent slopes.
379B1; 377B1,C1	Elk silt loam, 2 to 6 percent slopes. C1 6 to 12%.

The Elk series consists of deep, well drained soils that have developed in silty alluvium on low terraces.

Representative Profile

Horizon	Depth	Horizon Description
Ap	0 to 7"	Dark yellowish brown silt loam; fine granular structure; very friable; medium acid.
B1	7 to 12"	Dark brown silt loam; fine subangular blocky structure; friable; strongly acid.
B2t	12 to 28"	Dark brown to strong brown silty clay loam; medium subangular blocky structure; friable; common clay films; strongly acid.
B3t	28 to 43"	Strong brown to yellowish brown silty clay loam; fine and medium subangular blocky structure; friable; few clay films; very strongly acid.
C	43 to 63"	Strong brown silt loam mottled with pale brown and light brownish gray; structureless; friable; very strongly acid.

Important Features

Depth to rock: Ranges from 6 to 10 feet or more.

Water Table: Generally below 4 feet. Seasonally at about 2 to 3 feet.

Flood hazard: Moderate; once or twice in 5 years but some areas of this soil flood nearly every spring.

Runoff and Permeability: Low runoff and moderate permeability.

Remarks: This soil has a high available moisture capacity and has medium to high natural fertility. The flood hazard is the main limitation for most uses.

GILPIN SERIES

Map Symbol	Soil Phase Name
864C1; 80C1	Gilpin silt loam, 6 to 12 percent slopes.
864D1; 80D1, 864D3	Gilpin silt loam, 12 to 20 percent slopes.

The Gilpin series consists of moderately deep, well drained soils that have developed in shale and siltstone on ridgetops.

Representative Profile

Horizon	Depth	Horizon Description
O1	1 1/8 to 0"	Partially decomposed leaves and twigs.
A1	0 to 2"	Dark brown silt loam; fine and medium granular structure; very friable; 3 percent fragments; very strongly acid.
A2	2 to 5"	Yellowish brown silt loam; fine subangular blocky structure; friable; 5 percent fragments; very strongly acid.
B1t	5 to 10"	Yellowish brown silt loam; fine subangular blocky structure; friable; few clay films; 8 percent fragments; very strongly acid.
B2t	10 to 17"	Yellowish brown silty clay loam; medium subangular blocky structure; friable; common clay films; 20 percent fragments; very strongly acid.
B3t	17 to 32"	Yellowish brown silt loam, fine subangular blocky structure; friable; few clay films; 30 percent shale fragments; very strongly acid.
R	32" +	Strong brown weathered shale crushing to a gravelly silt loam, structureless; firm; very strongly acid.

Important Features

Depth to and kind of rock: Range from 2 to 3½ feet; shale or siltstone.

Runoff and permeability: Runoff is medium and permeability is moderate.

Erosion: Moderate to severe hazard.

Remarks: Soil may have perched water table above the siltstone rock during wet periods. Compaction potential is high.

HARTSELLS SERIES

Map Symbol	Soil Phase Name
805C1, B1	Hartsells fine sandy loam, 6 to 12 percent slopes.
805D1	Hartsells fine sandy loam, 12 to 20 percent slopes.

The Hartsells series consists of moderately deep, well drained soils that have developed in sandstone on ridgetops.

Representative Profile

Horizon	Depth	Horizon Description
O1	3½ to 0"	Hardwood leaves and twigs.
A1	0 to 7"	Dark brown fine sandy loam; granular structure; very friable; very strongly acid.
B1	7 to 12"	Yellowish brown fine sandy loam, fine subangular blocky structure; friable; very strongly acid.
B2t	12 to 20"	Yellowish brown sandy clay loam; fine and medium subangular blocky structure; friable; 2 percent sandstone fragments; common clay films; very strongly acid.
B3t	20 to 26"	Strong brown clay loam; fine subangular blocky structure; friable; common clay films; 5 percent fragments; very strongly acid.
C	26 to 36"	Strong brown sandy loam; fine subangular blocky structure; friable; few mica flakes; 35 percent fragments; very strongly acid.
R	36" +	Sandstone rock.

Important Features

Depth to and kind of rock: Ranges from 2 to 3 feet; sandstone.

Runoff and Permeability: Surface runoff is low; permeability is moderate.

Erosion: 805C1 - moderate
805D1 - moderately severe

Remarks: Soil is rocky in places and many ridges are narrow. Soil tends to be droughty.

JEFFERSON SERIES

Jefferson stony sandy loam below the sandstone cliff known as the Pottsville Escarpment. Notice the stones and boulders at the base of the cliff. This soil is well suited to hardwood production of oaks and yellow-poplar. The boulders cause equipment limitations in some places. Jefferson soil is extensive in the survey area.

Map Symbol	Soil Phase Name
41B1, C1, D1, E1, F1, 44B1, 44C1	Jefferson loam and gravelly loam.
43F1; 492F1	Jefferson stony sandy loam.
793C1, E1, F1; 725D1, 725D3, 725E1, 725E3, 725F1	Jefferson-Caneyville stony sandy loams.

Slope classes: B1-2 to 6%; C1-6 to 12%; D1-12 to 20%; E1-20 to 30%; F1-30 to 60%. 793C1 is 6 to 20 % slopes.

The Jefferson series consists of deep, well drained soils that have developed in sandstone and shale colluvium on steep sideslopes and toeslopes, generally below cliffs.

Representative Profile

Horizon	Depth	Horizon Description
O1	1 to 0"	Hardwood leaves and twigs.
A1	0 to 5"	Dark brown sandy loam; medium granular structure; very friable; 3 percent sandstone fragments; very strongly acid.
B1	5 to 10"	Brownish yellow sandy loam; fine subangular blocky structure; friable; 15 percent fragments; very strongly acid.
B21t	10 to 17"	Yellowish brown sandy loam; fine subangular blocky structure; friable; common clay films; 10 percent fragments; very strongly acid.
B22t	17 to 39"	Strong brown sandy clay loam; fine and medium subangular blocky structure; friable; many clay films; 15 percent fragments; very strongly acid.
B3	39 to 48"	Yellowish brown silty clay with common mottles of brownish yellow and pale brown; very fine subangular blocky structure; firm; few clay films; common soft shale fragments; very strongly acid.
C	48 to 80" +	Yellowish brown silty clay with common mottles of yellowish red and pale red; structureless; firm; common soft shale fragments; very strongly acid.

Important Features

Depth to and kind of rock: Ranges from 5 to 8 feet to shale, siltstone, limestone, or sandstone.

Runoff and Permeability: Runoff is moderate. Permeability is moderate.

Erosion Hazard: 41B1 - hazard is slight. 41C1, D1; 793C 1 - hazard is moderate. 41E1, F1; 43F1; 793E1, F1 - hazard is severe.

Remarks: Soil has a high available moisture capacity. It has equipment limitations because of surface stones and boulders on 43F1 and 793F1.

Map Symbol	Soil Phase Name
387A	Johnsburg silt loam, 0 to 4 percent slopes.

The Johnsburg series consists of deep, somewhat poorly drained soils that have developed in silty alluvium on gentle slopes on low terraces or broad ridges.

Representative Profile

Horizon	Depth	Horizon Description
Ap	0 to 8"	Brown silt loam with a few mottles of light yellowish brown; medium granular structure; very friable; slightly acid.
B1	8 to 15"	Light yellowish brown silt loam with a few gray mottles; fine subangular blocky structure; very friable; few clay films and pores; very strongly acid.
B2xt (fragipan)	15 to 55"	Light yellowish brown to light olive gray silt loam with light gray and yellowish brown mottles; medium and coarse angular blocky structure; firm; brittle and hard; common cavities and clay films; common pores and manganese concretions; very strongly acid.
B3	55 to 75"	Light gray and yellowish brown silt loam; fine subangular blocky structure; friable; very strongly acid.
R	75"	Siltstone bedrock.

Important Features

Depth to and kind of rock: Ranges from 4 to 10 feet or more; shale or siltstone.

Runoff and Permeability: Surface runoff is medium; permeability is slow.

Water Table: Generally at 2 to 3 feet, seasonal high is at the surface. Below 4 feet during dry season.

Flood Hazard: Variable. In places it floods nearly every year, but many areas hardly ever flood and some areas never flood. All areas of this soil can pond water for long periods.

Remarks: This soil has a fragipan at about 1½ to 2 feet that restricts the downward movement of water. Because of this characteristic, water ponds on the surface after heavy rain.

MONONGAHELA SERIES

Map Symbol	Soil Phase Name
383B1	Monongahela fine sandy loam, 2 to 6 percent slopes.
383C1	Monongahela fine sandy loam, 6 to 12 percent slopes.

The Monongahela series consists of deep, moderately well drained soils that have developed in sandy alluvium on high stream terraces.

Representative Profile

Horizon	Depth	Horizon Description
Ap	0 to 8"	Dark grayish brown fine sandy loam; medium granular structure; very friable; mildly acid.
B1	8 to 14"	Yellowish brown fine sandy loam; fine subangular blocky structure; friable; mildly acid.
B2t	14 to 21"	Yellowish brown fine sandy clay loam; fine and medium subangular blocky structure; friable; few clay films; slightly acid.
Bxt (fragipan)	21 to 48"	Yellowish brown to pale brown fine sandy clay loam with common mottles of light gray and strong brown; medium subangular blocky structure; firm; few clay films; very strongly acid.
B3	48 to 65"	Light yellowish brown clay loam with many mottles of light gray and yellowish red; fine subangular blocky structure; friable firm; common clay films; very strongly acid.
C	65 to 84"	Pale olive clay loam with many mottles of light gray and yellowish brown; structureless; firm; very strongly acid.

Important Features

Depth to and kind of rock: Ranges from 6 to 10 feet or more; siltstone or shale.

Runoff and permeability: Medium surface runoff with slow permeability.

Erosion: Hazard is slight to moderate.

Remarks: This soil has a fragipan at about 2 feet that restricts the downward movement of water.

MOREHEAD SERIES

Map Symbol	Soil Phase Name
480	Morehead silt loam, 0 to 2 percent slopes.

The Morehead series consists of deep, somewhat poorly drained soils that have developed in silty alluvium on nearly level low stream terraces.

Representative Profile

Horizon	Depth	Horizon Description
Ap	0 to 10"	Dark brown silt loam; fine and medium granular structure; very friable; medium acid.
B1	10 to 18"	Yellowish brown silt loam with a few mottles of light brownish gray; fine subangular blocky structure; friable; very strongly acid.
B2t	18 to 38"	Yellowish brown silt loam with many mottles of strong brown and light brownish gray; fine and medium subangular blocky structure; friable; common clay films and pores; very strongly acid.
B3	38 to 48"	Light yellowish brown silt loam with many mottles of strong brown and light brownish gray; fine subangular blocky structure; friable; few clay films in cavities; and a few pores; very strongly acid.
C	48 to 70"	Pale brown silt loam with many gray and strong brown mottles; structureless; firm; common cavities; very strongly acid.

Important Features

Depth to and kind of rock: Ranges from 4 to 10 feet or more; siltstone or shale.

Runoff and Permeability: Surface runoff is medium and permeability is moderate.

Water Table: Generally at 2 feet. Seasonal high is near the surface. It is below 4 feet during the dry season.

Flood Hazard: Variable. Some areas flood almost annually and other areas rarely flood while most areas flood occasionally. (once or twice in five years)

Remarks: Wetness restricts this soil for many uses.

MUSE SERIES

Map Symbol	Soil Phase Name
332B1	Muse silt loam, 2 to 6 percent slopes.
332C1	Muse silt loam, 6 to 12 percent slopes.
332D1	Muse silt loam, 12 to 20 percent slopes.
332E1	Muse silt loam, 20 to 30 percent slopes.
813F1	Muse-Trappist silt loam, 30 to 60 percent slopes.

The Muse series consists of deep, well drained soils that have developed in clayey colluvium from shales on gently sloping to steep hillsides.

Representative Profile

Horizon	Depth	Horizon Description
O1	1½ to 0"	Partially decomposed leaves and twigs.
A1	0 to 5"	Dark brown silt loam; medium granular structure; very friable; strongly acid.
B1t	5 to 11"	Strong brown silty clay loam; fine angular blocky structure; friable; few clay films; very strongly acid.
B2t	11 to 30"	Yellowish red silty clay; medium angular blocky structure; friable; many clay films; very strongly acid.
B3t	30 to 38"	Yellowish red silty clay with a few mottles of light brownish gray; medium angular blocky structure; firm; common clay films; very strongly acid.
C	38 to 62"	Red clay with common mottles of light gray and weak red; structureless; firm; very strongly acid.

Important Features

Depth to and kind of rock: 4 to 10 feet; hard black shale.

Runoff and Permeability: Surface runoff is medium to high, permeability is slow.

Erosion Hazard: 332B1, 332C1 - hazard is moderate
332D1, 332E1 - hazard is severe
813F1 - hazard is very severe and slump hazard is high.

Remarks: Soil has a low bearing capacity and becomes compacted easily.

POPE SERIES

Map Symbol	Soil Phase Name
181A; 116A	Pope fine sandy loam, 0 to 4 percent slopes.
181A2; 10A, 10C, 16A,16C	Pope fine sandy loam, nonacid, 0 to 4 percent slopes.
297	Pope gravelly fine sandy loam, 0 to 2 percent slopes.
237	Pope gravelly fine sandy loam, nonacid, 0 to 2 percent slopes.

The Pope series consists of deep, well drained soils that have developed in sandy alluvium on first bottoms.

Representative Profile

Horizon	Depth	Horizon Description
Ap	0 to 8"	Dark brown fine sandy loam; medium granular structure; very friable; very strongly acid.
B	8 to 48"	Dark brown fine sandy loam; medium and coarse granular structure; very friable; strongly acid. (237 and 297 units have 20 to 40 percent gravel in this layer)
C	48 to 85"	Dark yellowish brown fine sandy loam with a few lenses of loamy sand or sand; structureless; loose; very strongly acid. (237 and 297 units have 30 to 90 percent gravel in this layer)

Important Features

Depth to and kind of rock: Ranges from 4 to 7 feet or more; siltstone.

Water Table: Generally below 3 feet but seasonally at or near the surface. It is below 4 feet during the dry season.

Flood Hazard: Severe; soil floods nearly annually in most places but only occasionally in some areas.

Available Moisture: Medium to high for 181A2 and 181A, low for 237 and 297.

Remarks: Flood hazard limits the use of this soil for permanent facilities. Two of the mapping units,(297) and (237) are gravelly and are difficult to till, but are good sources of gravel.

RAMSEY SERIES

Map Symbol	Soil Phase Name
857D1, 836C1, 857C1, 011	Dekalb and Ramsey rocky sandy loams, 6 to 20 percent slopes.
857E1	Dekalb and Ramsey rocky sandy loams, 20 to 40 percent slopes.

(Ramsey soil is mapped with Dekalb soil)

The Ramsey series consists of shallow somewhat excessively drained soils that have developed in sandstone on ridges and steep slopes near cliffs.

Representative Profile

Horizon	Depth	Horizon Description
O1	3½ to 0"	Partially decomposed leaves and twigs.
A1	0 to 2"	Dark grayish brown sandy loam; fine granular structure; very friable; extremely acid.
A3	2 to 7"	Dark yellowish brown sandy loam; medium granular structure; very friable; 3 percent sandstone fragments; extremely acid.
B	7 to 14"	Yellowish brown sandy loam; medium granular to fine subangular blocky structure; very friable; 8 percent sandstone fragments; extremely acid.
R	14"	Sandstone bedrock.

Important Features:

Depth to and kind of rock: 6 to 20 inches; sandstone.

Runoff and permeability: Surface runoff is rapid and permeability is rapid.

Erosion: Moderate hazard on 857D1 and severe on 857E1.

Remarks: This rocky soil has low available moisture capacity and is droughty. This soil has severe limitations for nearly all uses because of its shallowness and rockiness.

RENOX SERIES

Map Symbol	Soil Phase Name
339B1	Renox gravelly silt loam, 2 to 6 percent slopes.
335B1	Renox gravelly fine sandy loam, 2 to 6 percent slopes.
335C1, D1	Renox gravelly fine sandy loam, 6 to 15 percent slopes.

The Renox series consists of deep, well drained soils that have developed in alluvium and colluvium on toeslopes and fans.

Representative Profile

Horizon	Depth	Horizon Description
Ap	0 to 14"	Dark brown gravelly silt loam; medium granular structure; very friable; 20 percent gravel; neutral.
B1t	14 to 23"	Dark brown gravelly silty clay loam; fine subangular blocky structure; very friable; few clay films; 15 percent gravel; neutral.
B2t	23 to 35"	Dark brown gravelly silty clay loam; very fine and fine subangular blocky structure; friable; common clay films; 25 percent gravel; neutral.
B3	35 to 45"	Dark brown light silty clay loam; very fine subangular blocky structure; friable; few clay films; 5 percent gravel; neutral.

Important Features

Depth to and kind of rock: Ranges from 4 to 8 feet; siltstone.

Runoff and Permeability: Surface runoff is low and permeability is moderate.

Erosion: Slight to moderate.

Remarks: Soil has high available moisture capacity and high natural fertility. A very productive soil.

ROBERTSVILLE SERIES

Map Symbol	Soil Phase Name
390	Robertsville silt loam, 0 to 2 percent slopes.

The Robertsville series consists of deep poorly drained soils that have developed in silty alluvium on low stream terraces.

Representative Profile

Horizon	Depth	Horizon Description
Ap	0 to 9"	Light gray to light brownish gray silt loam with a few mottles of strong brown; fine granular structure; friable; strongly acid.
Btg	9 to 16"	Gray silty clay loam with common mottles of strong brown and yellowish red; fine and medium subangular blocky structure; friable; few clay films; very strongly acid.
Bx (fragipan)	16 to 42"	Gray and yellowish brown silty clay loam; medium and coarse subangular blocky structure; very firm and brittle; few clay films; very strongly acid.
C	42 to 60"	Mottled gray and strong brown silty clay loam; structureless; firm; many black concretions; very strongly acid.

Important Features

Depth to and kind of rock: Ranges from 4 to 10 feet or more; siltstone.

Runoff and Permeability: Surface runoff is high and permeability is slow.

Water Table: Generally at about 2 feet but it is at or near the surface in wet periods and below 3 feet during dry periods.

Flood Hazard: Variable. In most places this soil floods annually but some areas rarely flood.

Remarks: This soil has a fragipan that restricts the downward movement of water and it ponds water on the surface after heavy rain. This soil has severe limitations for most uses due to the wetness. It has high compaction hazard and a low bearing capacity.

SHELOCTA SERIES

Map Symbol	Soil Phase Name
438D1	Wharton-Shelocta silt loams, 12 to 20 percent slopes.
438E1; 80E1, 80E3, 864E1, 81E1, 81E3, 883E1	Wharton-Shelocta silt loams, 20 to 30 percent slopes.
438F1; 840F1, 840F3, 840G1, 867F1, 883F1	Wharton-Shelocta silt loams, 30 to 50 percent slopes.

The Shelocta series consists of deep, well drained soils that have developed in shale colluvium on strongly sloping to steep slopes. They are mapped with the Wharton soils.

Representative Profile

Horizon	Depth	Horizon Description
O1	1½ to 0"	Partially decomposed leaves and twigs.
A1	0 to 8"	Dark brown silt loam; medium granular structure; very friable; 5 percent shale fragments; strongly acid.
B1t	8 to 14"	Yellowish brown silt loam; fine subangular blocky structure; friable; 5 percent shale fragments; few clay films; strongly acid.
B2t	14 to 36"	Strong brown silty clay loam; fine and medium subangular blocky structure; friable; 10 percent shale fragments; common clay films; very strongly acid.
B3t	36 to 47"	Yellowish brown silty clay loam with mottles of pale brown, strong brown and light gray; fine and very fine subangular blocky structure; firm; 10 percent shale fragments; common clay films; very strongly acid.
C	47 to 64"	Yellowish brown silty clay with many mottles of light gray, strong brown and yellowish red; coarse angular blocky structure; firm; 2 percent fragments; very strongly acid.

Important Features

Depth to and kind of rock: Ranges from 4 to 9 feet or more; shale or siltstone.

Runoff and Permeability: Rapid surface runoff and moderately slow permeability. Available moisture is high.

Erosion: Severe hazard.

Remarks: The soil has a high water holding capacity. It has a severe slump hazard when cut for roads or construction purposes.

SHOALS SERIES

Map Symbol	Soil Phase Name
112	Shoals fine sandy loam

The Shoals series consists of deep, poorly drained soils of the bottoms that have developed in alluvium.

Representative Profile

Horizon	Depth	Horizon Description
Ap	0 to 7"	Dark brown fine sandy loam with many gray and yellowish brown mottles; medium granular structure; very friable; 2 percent gravel; neutral.
B1	7 to 20"	Grayish brown fine sandy loam with many gray and dark yellowish brown mottles; fine subangular blocky structure; wet and sticky; 2 percent gravel; neutral.
B2	20 to 36"	Gray fine sandy loam with many mottles of light olive brown; fine subangular blocky structure; wet and sticky; 2 percent gravel; neutral.
C	36 to 45"	Olive gray fine sandy loam; massive structure; wet and sticky; 2 percent gravel; neutral.

Important Features

Depth to and kind of rock: Ranges from 4 to 8 feet; siltstone.

Runoff and Permeability: Surface runoff is moderate and permeability is slow because of the high water table.

Erosion: Slight hazard.

Water Table: At or near the surface during wet periods. Generally 1 to 2 feet.

Remarks: The soil has a high water table but has a high available moisture capacity and high natural fertility. Wetness restricts the use of this soil for recreation and roads.

STENDAL SERIES

Map Symbol	Soil Phase Name
185	Stendal fine sandy loam, 0 to 2 percent slopes.
286	Stendal gravelly fine sandy loam, 0 to 2 percent slopes.
184	Stendal silt loam, 0 to 2 percent slopes.

The Stendal series consists of deep, somewhat poorly drained soils that have developed in alluvium on first bottoms.

Representative Profile

Horizon	Depth	Horizon Description
Ap	0 to 8"	Dark brown fine sandy loam, with a few mottles of light brownish gray; medium granular structure; friable; very strongly acid.
B	8 to 22"	Light brownish gray fine sandy loam with common mottles of pale olive and light olive brown; medium subangular blocky structure; very friable; common pores; very strongly acid.
C	22 to 72"	Light olive gray fine sandy loam to loam with many mottles of olive and yellowish brown; structureless; friable; common pores; very strongly acid.

Important Features

Depth to and kind of rock: Ranges from 4 to 8 feet or more; siltstone.

Runoff and Permeability: Moderate surface runoff and moderately rapid permeability above the water table.

Water Table: Generally at about 2 feet but it is near the surface during wet periods and below 3 feet during dry periods.

Flood Hazard: Severe; most areas of this soil flood annually but some areas flood more or less often.

Remarks: Wetness restricts most uses of this soil. Drainage is often difficult because outlets are scarce. Build-up is necessary for intensive use.

STRIP MINES

Map Symbol	Soil Phase Name
043	Fire clay or limestone strip mine.

This is a miscellaneous land type that consists of areas where the material above the fire clay or limestone bed has been removed to allow open pit mining, mostly on ridgetops or benches above steep soils.

Description

1. The high wall - the vertical face on the uphill side of the mine exposing the sandstone, shale and limestone rock.

2. The spoil bank - the overburden on the downhill side composed of soil, shale, sandstone, fire clay and limestone waste materials.

3. The pond - between the high wall and spoil bank, water often accumulates forming a pool.

Important Features

Erosion Hazard: Severe to very severe. Materials are generally high in clay.

Slump Hazard: Severe to very severe when saturated with water.

Runoff and Permeability: Runoff is severe, permeability is moderately low.

Water pollution to streams: Severe after rains.

Remarks: Natural fertility of the spoil bank is very low except where calcareous material is included in the mixture. Reaction varies from extremely acid to alkaline. Available moisture varies from low to medium.

TALBOTT SERIES

Numerous shrubs and vines on Talbott very rocky silt loam. Notice the limestone rocks. This soil has high natural fertility but low productivity potential for trees. It has severe limitations for road construction and recreational use. A good use is wildlife clearings for supplying wild natural herbaceous and woody plants. This soil is of limited extent.

TALBOTT SERIES

Map Symbol	Soil Phase Name
707C1; 704C1, 725C1, 725C2, 725D2	Talbott very rocky silt loam, 6 to 20 percent slopes.
707E1	Talbott very rocky soils, 20 to 40 percent slopes.

The Talbott series consists of moderately deep, rocky soils that have developed in limestone on ridgetops and upper sideslopes.

Representative Profile

Horizon	Depth	Horizon Description
O1	1 to 0"	Partly decomposed hardwood leaves.
A1	0 to 3"	Very dark grayish brown silty clay loam; medium and coarse granular structure; friable; 3 percent gravel; mildly alkaline.
B1t	3 to 8"	Brown silty clay; fine and medium subangular blocky structure; friable to firm; few clay films; 3 percent gravel; neutral.
B21t	8 to 13"	Reddish brown silty clay; fine and very fine subangular blocky structure; firm-sticky and plastic; common clay films; 2 percent gravel; neutral.
B22t	13 to 25"	Yellowish red clay; fine and very fine subangular blocky structure; firm-sticky and plastic; common clay films; 2 percent gravel; neutral.
B3	25 to 31"	Yellowish red clay with common mottles of very dark grayish brown and brownish yellow; fine and very fine subangular blocky structure; firm-sticky and plastic; neutral.
R	31"	Limestone rock.

Important Features

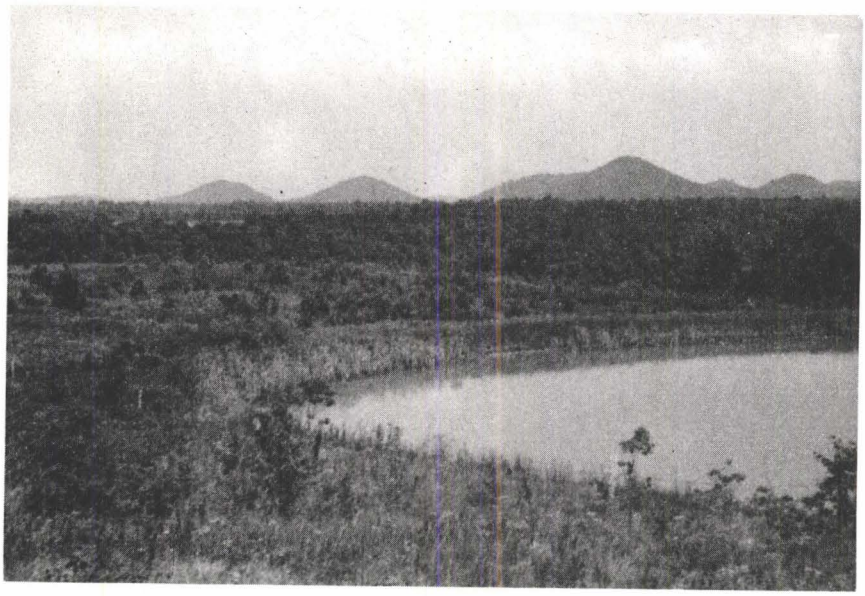
Depth to and kind of rock: 25 to 40 inches; limestone. Some places a shale layer is above the limestone.

Runoff and Permeability: Rapid surface runoff; permeability is slow.

Erosion: 707C1 - hazard is severe; 707E1 - hazard is very severe.

Remarks: Soil has a low available moisture capacity; high natural fertility; and low bearing capacity.

TILSIT SERIES



An excellent pond on the gently sloping Tilsit silt loam soil. Tilsit soils have a fragipan at about 24 inches and they are slowly permeable. Tilsit soils are best suited to hardwood production of oaks, but if the hardwood competition can be controlled it produces good yellow pine. These soils make excellent wildlife clearings for grasses and legumes, as well as ponds. Because of the fragipan these soils have severe limitations for septic tank filter fields. Tilsit soils are of moderate extent.

TILSIT SERIES

Map Symbol	Soil Phase Name
86B1	Tilsit silt loam, 2 to 6 percent slopes.
86C1	Tilsit silt loam, 6 to 12 percent slopes.

The Tilsit series consists of deep moderately well drained soils that have developed in old alluvium and residuum from acid shales on gentle slopes on high terraces and broad ridgetops.

Representative Profile

Horizon	Depth	Horizon Description
Ap	0 to 8"	Dark brown silt loam; fine and medium granular structure; very friable; neutral.
B1	8 to 14"	Yellowish brown silt loam; fine and medium sub-angular blocky structure; friable; slightly acid.
B2t	14 to 25	Yellowish brown silt loam with many mottles of pale brown, strong brown, and light gray; fine sub-angular blocky structure; few clay films; friable; very strongly acid.
Bx1 (fragipan)	25 to 42"	Yellowish brown and light brownish gray silt loam; coarse prismatic to coarse angular blocky structure; firm to brittle; few clay films; very strongly acid.
Bx2 (fragipan)	42 to 75"	Yellowish brown silt loam with mottles of light brownish gray; coarse prismatic to medium angular blocky structure; hard and brittle; few clay films; very strongly acid.
C	75 to 120"	Gray silt loam with many mottles of strong brown; structureless; firm; very strongly acid.

Important Features

Depth to and kind of rock: Ranges from 3½ to 15 feet; shale or siltstone.

Runoff and Permeability: Medium surface runoff; slow permeability.

Erosion: Hazard is slight to moderate.

Remarks: This soil has a fragipan at about 17 to 26 inches that restricts the downward movement of water.

TRAPPIST SERIES

Map Symbol	Soil Phase Name
813F1	Muse-Trappist silt loams, 30 to 60 percent slopes.

The Trappist series consists of moderately deep, well drained clayey soils that have developed in hard black shales on upper sideslopes and ridges.

Representative Profile

Horizon	Depth	Horizon Description
O1	½ to 0"	Hardwood leaves and twigs.
A1	0 to 2"	Dark brown shales, silt loam, very fine granular structure; very friable; 15 percent shale fragments; very strongly acid.
B1t	2 to 6"	Strong brown silty clay loam; fine subangular blocky structure, friable; few clay films; 8 percent shale fragments; very strongly acid.
B2t	6 to 23"	Yellowish red silty clay; fine and medium subangular blocky structure; firm; common clay films; 10 percent shale fragments; very strongly acid.
B3	23 to 30"	Red clay; fine and medium subangular blocky structure; firm; 10 percent shale fragments, very strongly acid.
R	30"	Black shale.

Important Features

Depth to and kind of rock: 24 to 36"; black shale that is brittle and hard.

Runoff and Permeability: High surface runoff rate and slow permeability.

Erosion: Severe hazard.

Remarks: Soil often has shale fragments on the surface which tend to increase the surface runoff. Soil is droughty.

Map Symbol	Soil Phase Name
83B1; 864B1	Whitley silt loam, 2 to 6 percent slopes.
83C1	Whitley silt loam, 6 to 12 percent slopes.
83D1	Whitley silt loam, 12 to 20 percent slopes.

The Whitley series consists of moderately deep, well drained soils that have developed in old alluvium and residuum of acid siltstones and shales on high stream terraces and on broad gently rolling to sloping ridgetops.

Representative Profile

Horizon	Depth	Horizon Description
O1	1¼ to 0"	Hardwood leaves and twigs.
A1	0 to 3"	Dark grayish brown silt loam with few mottles of light olive brown; fine granular structure; very friable; very strongly acid.
A2	3 to 7"	Light olive brown silt loam medium granular to fine subangular blocky structure; friable; very strongly acid.
B1	7 to 12"	Yellowish brown heavy silt loam; fine subangular blocky structure; friable; very strongly acid.
B2t	12 to 29"	Yellowish brown silt loam to light silty clay loam with common mottles of pale brown; fine and medium subangular blocky structure; friable; common clay films; 3 percent gravel; very strongly acid.
B3	29 to 38"	Brownish yellow light silty clay loam with common mottles of pale brown and strong brown; fine and very fine subangular blocky structure; friable to firm; 15 percent weathered sandstone and shale fragments; very strongly acid.
R	38" +	Weathered shale and sandstone with some mica flakes; light yellowish brown and yellowish brown silt loam to light silty clay loam; very strongly acid.

Important Features

Depth to and kind of rock: Ranges from 3 to 4 feet; siltstone and shale.

Runoff and Permeability: Surface runoff is medium, permeability is moderate to moderately slow.

Erosion hazard: 83B1, 83C1 - hazard is slight: 83D1 - hazard is slight to moderate.

Remarks: The soil has a moderately high available moisture capacity.

A young oak stand on Wharton silt loam. This soil is best suited to hardwood production. Conversion to pine will require several release treatments. White pine grows well on this soil. This soil is subject to severe compaction when used for recreational facilities and the erosion hazard is severe when disturbed. Wharton is an extensive soil.

Map Symbol	Soil Phase Name
892C1; 882C1, 803C1, 825C1	Wharton silt loam, 6 to 12 percent slopes.
892D1; 882D1, 803D1, 821D1, 821D3, 825D1	Wharton silt loam, 12 to 20 percent slopes.
892D3	Wharton silty clay loam, 12 to 20 percent slopes severely eroded.
892E1 or 882E1	Wharton silt loam 20 to 30 percent slopes.
438D1	Wharton-Shelocta silt loams, 12 to 20 percent slopes.
438E1; 80E1, 80E3, 864E1, 81E1, 81E3, 883E1	Wharton-Shelocta silty loams, 20 to 30 percent slopes.
438F1; 840F1, 840F3, 840G1, 867F1, 883F1	Wharton-Shelocta silt loams, 30 to 50 percent slopes.

The Wharton series consists of moderately deep, well drained, clayey soils that have developed in clayey shales on ridgetops and convex sideslopes.

Representative Profile

Horizon	Depth	Horizon Description
Ap	0 to 6"	Dark brown silt loam, medium granular structure; friable; 2 percent shale fragments; very strongly acid.
B1	6 to 11"	Yellowish brown silty clay loam; fine subangular blocky structure; friable; 2 percent shale fragments; very strongly acid.
B2t	11 to 20"	Strong brown silty clay; fine and medium subangular blocky structure; firm; common clay films; 4 percent shale fragments; very strongly acid.
B3t	20 to 25"	Yellowish brown silty clay with common mottles of light brownish gray and strong brown; medium subangular blocky structure; firm; common clay films; 4 percent shale fragments; very strongly acid.
C	25 to 36"	Pale brown silty clay with many mottles of light gray and strong brown; medium subangular blocky structure; firm; 4 percent shale fragments; very strongly acid.
R	36" +	Pale brown, light gray and strong brown clayey shale.

Important Features

Depth to and kind of rock: 2½ to 3½ feet; shale or siltstone.

Runoff and Permeability: Rapid runoff rate and slow permeability.

Erosion: Severe hazard. Moderate hazard on C slopes.

Remarks: Soil has high compaction hazard and a low bearing capacity.

PART III SOIL USE AND MANAGEMENT

The purpose of a soil survey is to show the location of the different kinds of soils on aerial photographs and to make predictions about the potential behavior of each soil under different uses. Because the soil survey provides a great deal of information about the land, it is an invaluable aid to land use planning. Soil survey information can be used for specific detailed planning for a small area or for broad general plans often made for large areas. Whether a land manager is goint to plant trees, construct a building on a particular plot of land, or make a general multiple use plan for a Ranger District, he can receive detailed information from the soil survey that will help him make decisions.

Some soils are better suited for a particular use than others and the most suitable soils for a use can be located on the soil map. There are, depending on the situation, different approaches to obtain full benefits from the information provided in this Soil Management Report. One is where you have a particular use in mind and need to select the best possible site. An example of this situation would be selecting suitable soils for planting walnut trees. Another approach is where, for one reason or another, you have already selected the site for a particular use and need to know what problems, if any, will be encountered and how to overcome them. An example would be compiling engineering and watershed data on soils to be used for a road so that slumps and erosion can be minimized through design.

During the course of the soil survey when the soils are classified and mapped, many different kinds of yields and behavioral data are collected and recorded. From this information and from data collected on similar soils in other counties, the interpretations were developed for this report. The interpretation data is arranged in groups for convenience of use and offers land managers the opportunity to plan for the best use of all soils. The soil interpretations presented do not dictate the use of the soil, but rate their potentials and suitability for various uses.

A. Soil Management Areas

The map can be used as a General Soil Map, General Geology Map or General Topographic Map depending on the needs of the user. A strong relationship exists between the soils, geology and topography.

After the soils in the survey area were mapped in detail, it was possible to make a general map that shows several main soil, geologic and landscape patterns called Soil Management Areas. The map showing the location of the Soil Management Areas is in the back of this report. Each Soil Management Area contains a few major soils and several minor soils in a pattern that is characteristic although not strictly uniform. The geology and topography also occur in a pattern that is fairly uniform.

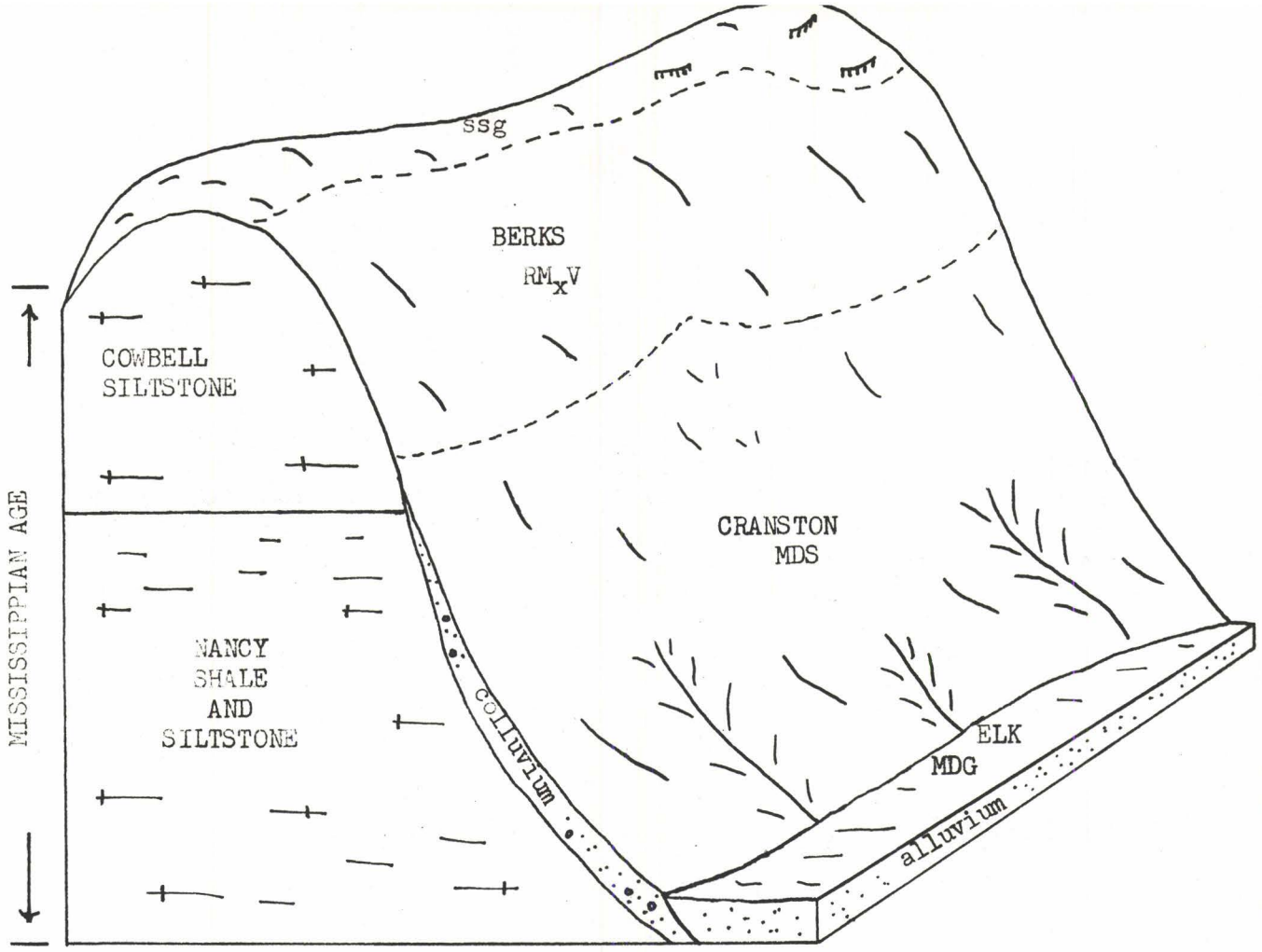
The soils within any one Management Area often differ from each other in some or in many characteristics; for example, slope, depth, stoniness or texture. Therefore, the Soil Management Area Map shows patterns of different kinds of soils that commonly occur together on characteristic landscapes and geologic formations.

Each Soil Management Area is named for the major soil series in it, but, as already noted, soils of other series may also be present. The major soil of one management area may also be present in other management areas, but in different patterns and proportions.

The Soil Management Area Map is useful to people who want a general idea of the soils, geology or topography, who want to compare the different geographical parts of the survey area, or for broad multiple use management planning. They are particularly useful in wildlife planning and watershed management for general planning. Detailed plans for specific areas cannot be made from the soil management area map. Refer to section III of this report for specific soil interpretations.

There are three parts to this section: (1) the block diagrams which illustrate the soil, geology and landscape relationship, (2) the written description for each Soil Management Area, and (3) the map at the back of this report.

The block diagrams show the hydrologic soil unit (HSU) for each soil. The key for these is in the water section of Part III.



1. CRANSTON-BERKS SOIL MANAGEMENT AREA

1. Cranston - Berks Soil Management Area

This soil management area consists of a deeply dissected landscape with very narrow winding ridgetops, very steep sideslopes and moderately wide bottoms. The soils have developed from Mississippian Age acid siltstones and shales of the Cowbell and Nancy members of the Borden Formation. They are well drained, very strongly acid and low in natural fertility.

The Cranston soils occupy the lower one-half to two-thirds sideslopes and toeslopes and make up about 60 percent of this area. These deep soils have gravelly silt loam subsoil which consists of 10 to 35 percent siltstone and shale fragments.

The Berks soils occupy the very steep upper third of the sideslopes and noses. These soils make up about 30 percent of this area and they are moderately deep with gravelly silt loam subsoil which contain 40 to 70 percent siltstone fragments.

The remaining 10 percent of this area consists of a stony soil on the ridgetop which is similar to Berks but is shallower.

This is mainly a forested management area with very little pasture. The ridges, upper slopes and south facing slopes support chestnut and scarlet oaks, and hickories, while white oak and yellow-poplar dominate the lower slopes and northern aspects. Oaks on the Berks soil are generally low quality.

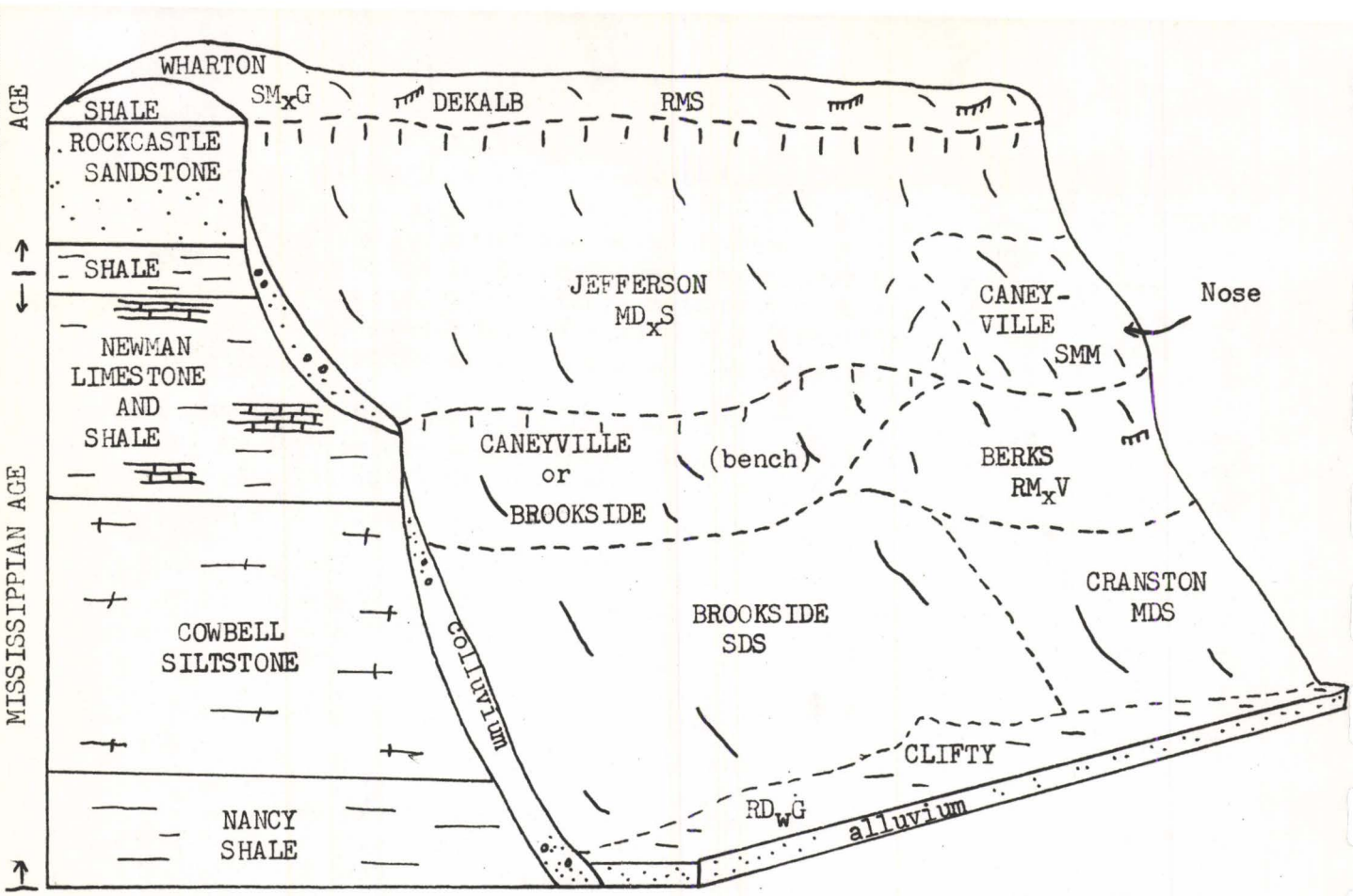
Management Situation

The Cranston soils have an oak site quality of fair to good and should be managed for hardwoods on the north facing sideslopes and possibly hardwood-pine on the upper south facing sideslopes. The Berks soils have an oak site quality of poor to fair and preferred management would be pine or pine-hardwood but, because of the erosion hazard, and rapid surface runoff, the present vegetation on the Berks should be maintained for watershed protection and wildlife management.

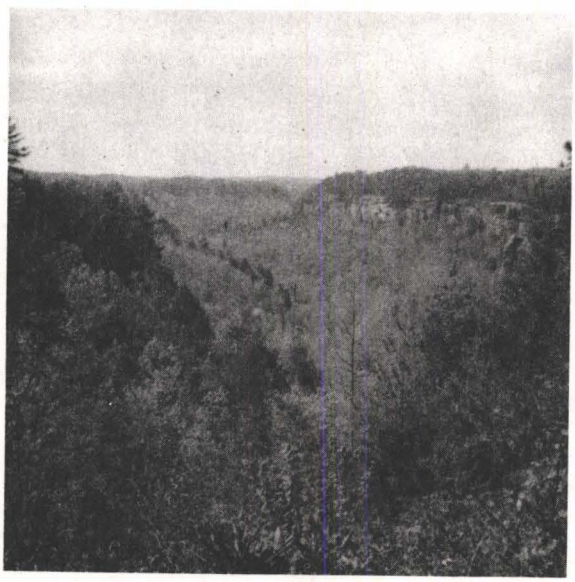
Wildlife habitat is good at present for squirrel because of the cover-type in this area. The oaks and hickories generally provide a good mast source. The area has fair potential for deer and grouse.

Engineering projects in this area require some adjustment because the soils have a severe erosion and slump hazard. Recreational use potential of the soils is low for campgrounds and high for hiking. Roads, trails, tent pads, and picnic areas should be surfaced.

Water storage capacity is low, Surface runoff is very high and produces sharp fluctuations in stream flows following rain. Streams are nearly dry within a day or two after a heavy rainfall in the summer but run continously during wet months. Springs from lower mountainsides flow after heavy rains.



2. JEFFERSON-BROOKSIDE-DEKALB SOIL MANAGEMENT AREA



2. Jefferson-Brookside-Dekalb Soil Management Area

This soil management area has a deeply dissected landscape with long, steep, benchy and stony sideslopes below a sandstone cliff. Wide ridges and short rounded sideslopes occur above the cliff. The soils have developed from Pennsylvanian Age sandstones and shales of the Lee Formation and Mississippian Age limestone and shale of the Newman Formation and upper Borden Formation. These soils are well to excessively drained. The Jefferson and Dekalb soils are very strongly acid and are low in natural fertility, and Brookside soils are slightly acid and high in natural fertility.

The Jefferson soils lie on the steep sideslopes below the sandstone cliff with a 5 to 20 percent stone and boulder cover. Jefferson is a deep soil with a sandy clay loam subsoil and it makes up about 45 percent of this area.

The Brookside soils occupy the bench and steep sideslope positions below the limestone cliff or outcrop. Brookside is a deep soil with a clayey subsoil and it makes up about 25 percent of this area. In the upper reaches of some of the larger drainages, the Brookside soil is absent.

The Dekalb soils are rocky and occupy the ridges and short, rounded sideslopes above the sandstone cliff. Dekalb is a moderately deep soil with a sandy loam subsoil and it makes up about 15 percent of this area.

The remaining soils are the moderately deep Hartsells, Wharton and Gilpin soils and the deep Cranston soils.

This area is forested with cove hardwoods, oaks, and yellow poplar. White pine and hemlock is in the deep coves. Chestnut oak, scarlet oak and yellow pine dominate on the short slopes above the sandstone cliff.

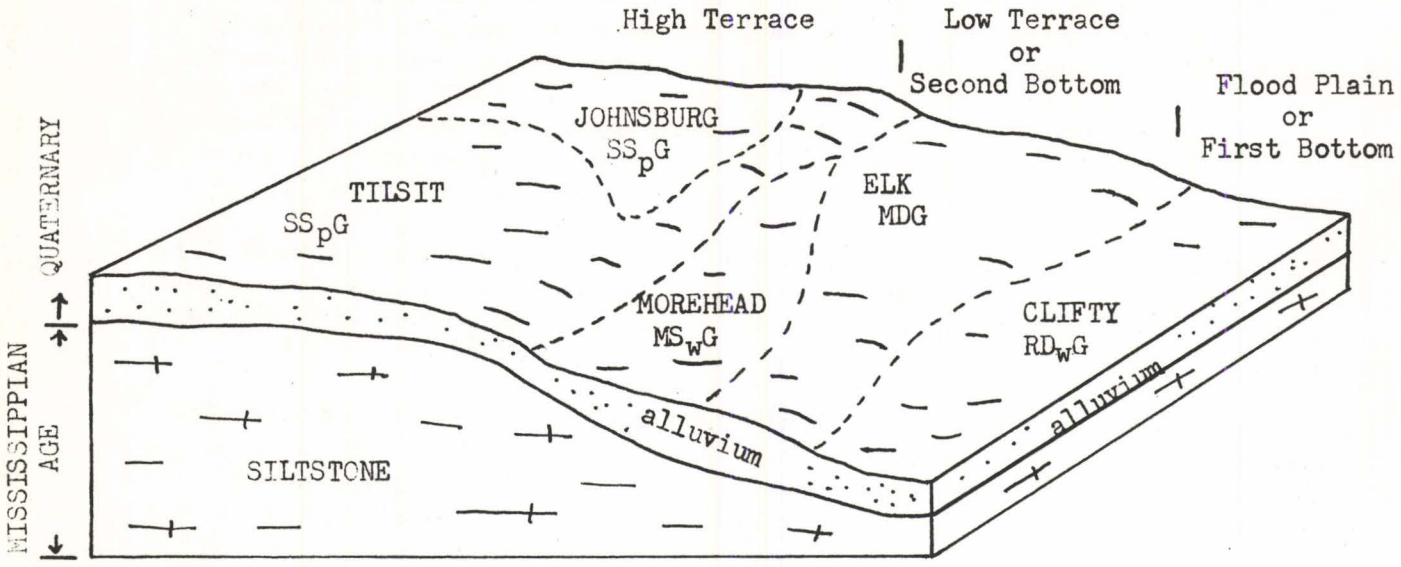
Management Situation

Jefferson and Brookside soils have good oak site quality on the north facing sideslopes and the lower portion of the south facing sideslopes. These should be managed for yellow poplar, white pine or cove hardwoods. The upper portion of the south facing sideslopes are fair and should be managed for oaks. The Dekalb soils have a poor to fair oak site quality and should be managed for pine or pine-hardwoods.

Wildlife habitat in this area favors all four primary forest game species. Wildlife ponds and clearings can be placed on the toeslopes or benches.

The major soils have severe limitations for camp and picnic sites and moderate limitations for hiking and nature trails and scenic overlooks. Cliffs and the severe erosion and slide hazards are factors to be considered in road location and design.

Streams in this area have peak flows of fairly long duration but these flows usually occur only once or twice annually. Continually flowing streams are common. The water storage capacity is medium to high.



3. TILSIT-ELK-CLIFTY SOIL MANAGEMENT AREA

3. Tilsit-Elk-Clifty Soil Management Area

This soil management area is on broad, nearly level floodplains and stream terraces. The soils are developed in alluvium washed from acid shales and siltstones. The alluvium ranges from 3 to 40 feet deep overlying hard siltstone and dominant textures are silt loam, silty clay loam, gravelly silt loam and fine sandy loam.

The Tilsit soils are moderately well drained, low in natural fertility and very strongly acid. The Elk and Clifty soils are well drained, medium in natural fertility and are very strongly acid.

The Tilsit soils occupy the gently sloping to sloping high stream terraces. These soils are characterized by a hard fragipan which varies in depth from 17 to 26 inches. Tilsit is a deep soil with a silt loam subsoil and it makes up about 40 percent of this area.

The Elk soils occur on the low stream terraces and make up about 25 percent of this area. Elk is a deep soil with a silt loam subsoil.

The deep Clifty soils occur on the nearly level floodplains and make up about 25 percent of this area. Clifty soils have a characteristic gravel subsoil layer with gravel content ranging from 50 to 90 percent.

Small portions of the Johnsburg soils on the high stream terraces; the Morehead soils on nearly level low stream terraces and Pope soils on nearly level floodplains make up the rest of this area.

Most of this area is privately owned and producing pasture, hay, row crops, tobacco or corn. Some old fields are in government ownership. Most old fields are reverting to a pine-oak cover type but some wet soils are in yellow poplar, sweetgum and other bottomland hardwoods.

Management Situation

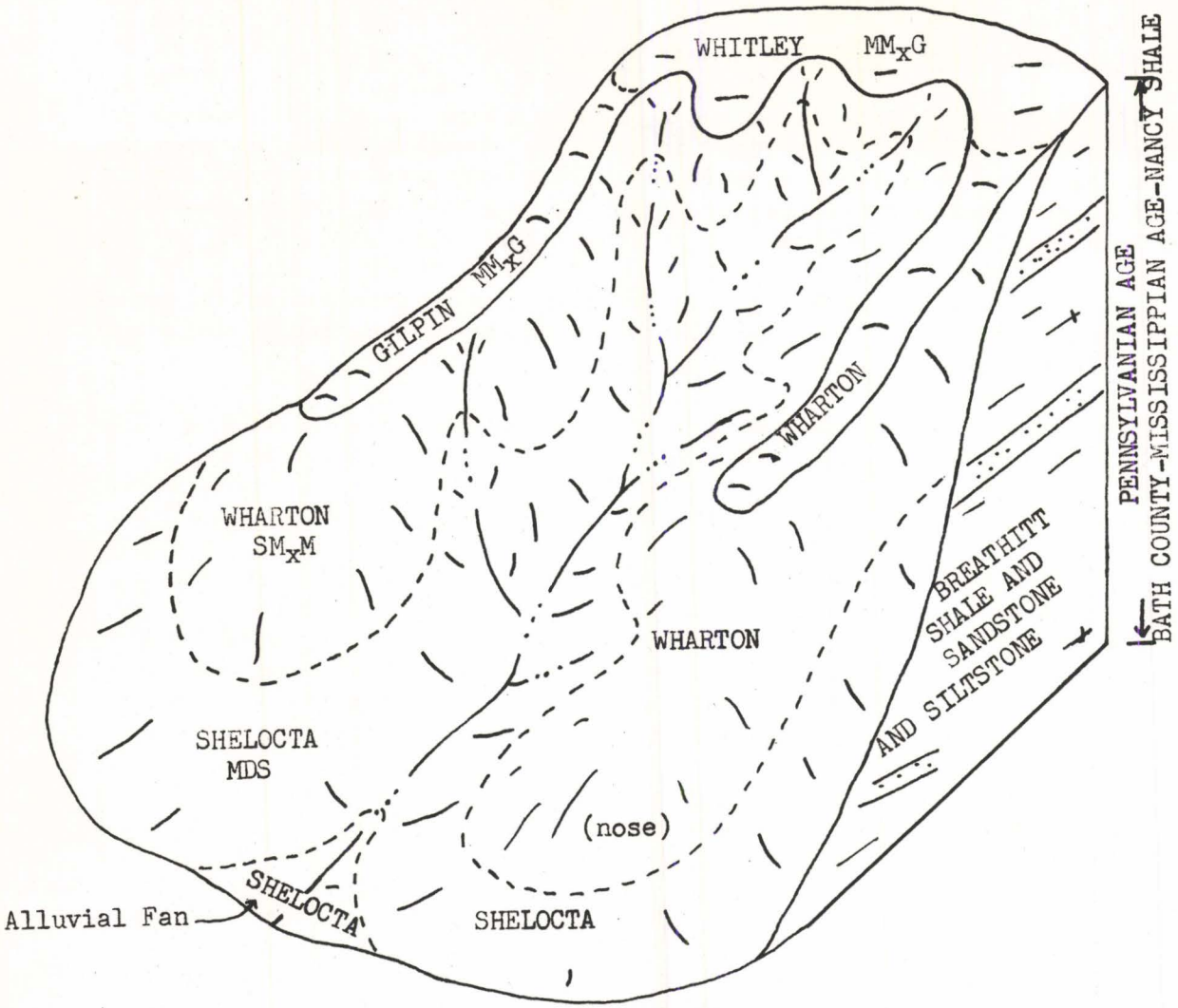
This area has a high potential for timber management. The Tilsit soils have a good oak site quality and they should be managed for oaks. The Elk and Clifty soils have a very good site quality for yellow poplar and oaks.

This area has a good wildlife habitat for rabbits and quail because a large portion is open fields of pasture or corn. Grouse and deer pass through and use this area for food but do not stay because there is a lack of cover. This management area complements adjacent areas for deer and grouse management. Ponds can be constructed on Tilsit soils.

Limitations for recreational use of the soils are slight to moderate. The potential for campgrounds and picnic areas is high.

The erosion hazards are slight. Elk and Clifty soils have a flood hazard.

Water storage capacity is medium. Nearly one-half of the land area is moderately well drained. Tilsit, Johnsburg and Robertsville soils have fragipans which restrict permeability. The surface runoff is medium.



4. WHARTON-SHELOCTA SOIL MANAGEMENT AREA

4. Wharton-Shelocta Soil Management Area

This soil management area has a well dissected landscape with narrow ridges and short smooth to concave sideslopes. The soils have developed from Pennsylvanian Age acid soft shales and sandstones of the Breathitt Formation. These soils are well drained, very strongly acid and low in natural fertility.

The Wharton soils occupy ridges, convex sideslopes and noses. They are moderately deep and have a silty clay subsoil and make up about 45 percent of this area.

The Shelocta soils occupy concave slopes. They are deep and have a light silty clay loam subsoil and make up about 35 percent of this area.

The remaining 20 percent consists of the moderately deep Whitley soils on the ridgetop; the deep Jefferson soils in heads of drains or concave slopes; and the moderately deep Gilpin soils on the ridgetops.

Most of this area is privately owned and producing pasture, hay or row crops. The rest is in forest or is being reverted into forest. The cover is mainly mixed oaks and pines. Some areas are severely eroded.

Management Situation

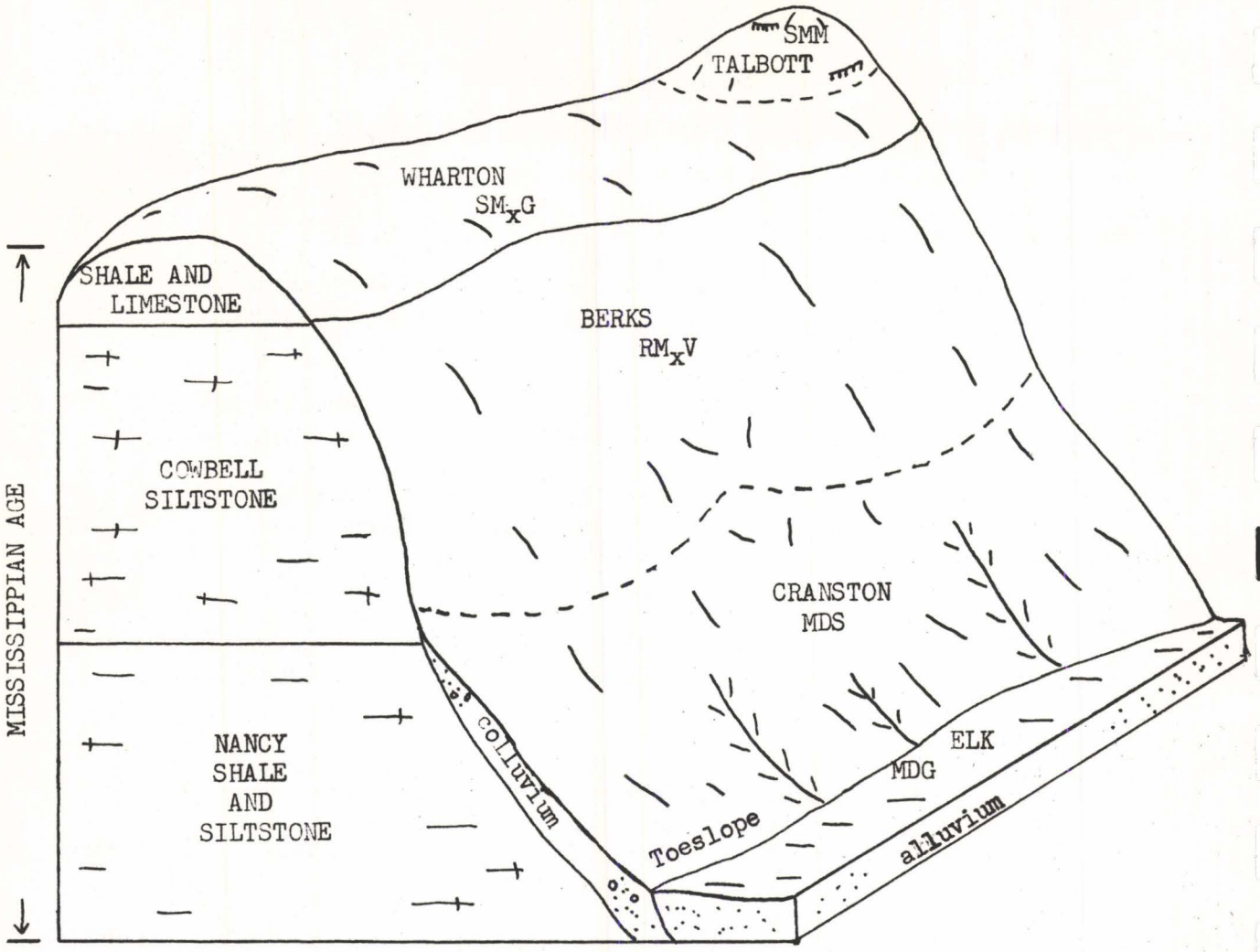
The Wharton and Shelocta soils have a fair to good oak site quality. Yellow-poplar could be managed on the lower north facing side slopes. Old fields can be planted to white pine but generally these soils should be managed for hardwoods.

Wildlife habitat favors squirrel especially on northerly aspects. Good deer and grouse habitat can be maintained on ridges and southerly aspects. Ponds and clearings can be easily established on ridgetops.

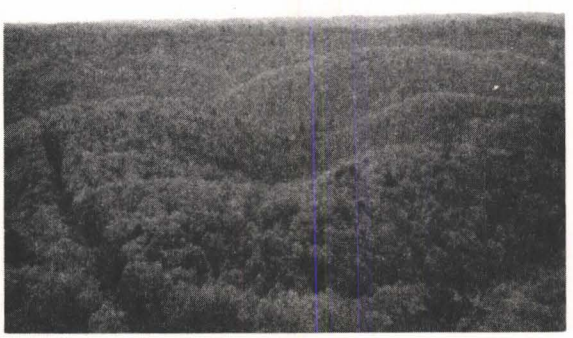
Recreational use of this area is limited due to the compaction and erosion hazards of the soils. Sites with soils acceptable for camp sites are few.

Road construction hazards are increased by the very severe erosion and severe slump hazards. Cuts deeper than 4 feet are not recommended. Surfacing of roads for year-round use and proper cross draining is necessary.

Water storage capacity is high but runoff is concentrated during the wetter months. Because much of the area is cleared the surface runoff is high. Stream fluctuation following high intensity storms is rapid but of short duration, and the water is muddy. High gradient drainages are numerous.



5. BERKS-CRANSTON-WHARTON SOIL MANAGEMENT AREA



5. Berks-Cranston-Wharton Soil Management Area

This soil management area is similar to the Cranston-Berks area except it has broader ridges of Wharton soil. It has very steep sideslopes and broad ridgetops. The soils have developed from Mississippian Age siltstones, limestones and shales of the Borden, Newman and Pennington Formation. In places the Pennsylvanian Age Lee Formation forms a sandstone cap on ridges. The soils are well drained, very strongly acid and low in natural fertility.

The Berks soils are moderately deep and have gravelly silt loam subsoil that contains from 40 to 70 percent fragments. It lies on the very steep side slopes and noses with a few rock outcrops, and makes up about 35 percent of this area.

The Cranston soils are deep with a gravelly silt loam subsoil that has 10 to 35 percent fragments. It lies on the steep lower sideslopes and toeslopes and makes up about 25 percent of this area.

The Wharton soils have developed from clayey shales and are on the ridgetops and upper slopes. They are moderately deep, have a silty clay subsoil and make up about 15 percent of this area.

The remaining soils making up the ridgetops are the moderately deep Hartsells and Dekalb soils from sandstone, the moderately deep Gilpin soils from siltstone, and the moderately deep Talbott soils from limestone. Small areas of the deep Jefferson soils are on some steep upper slopes below the Dekalb soils.

The steep sideslopes are forested with a cover of chestnut and scarlet oaks on the Berks soils and mixed oaks, hickories and yellow-poplar on the Cranston soils. Wharton soils are mostly covered with oaks and hickories. Some old fields are in pine and some areas are in pasture or hay.

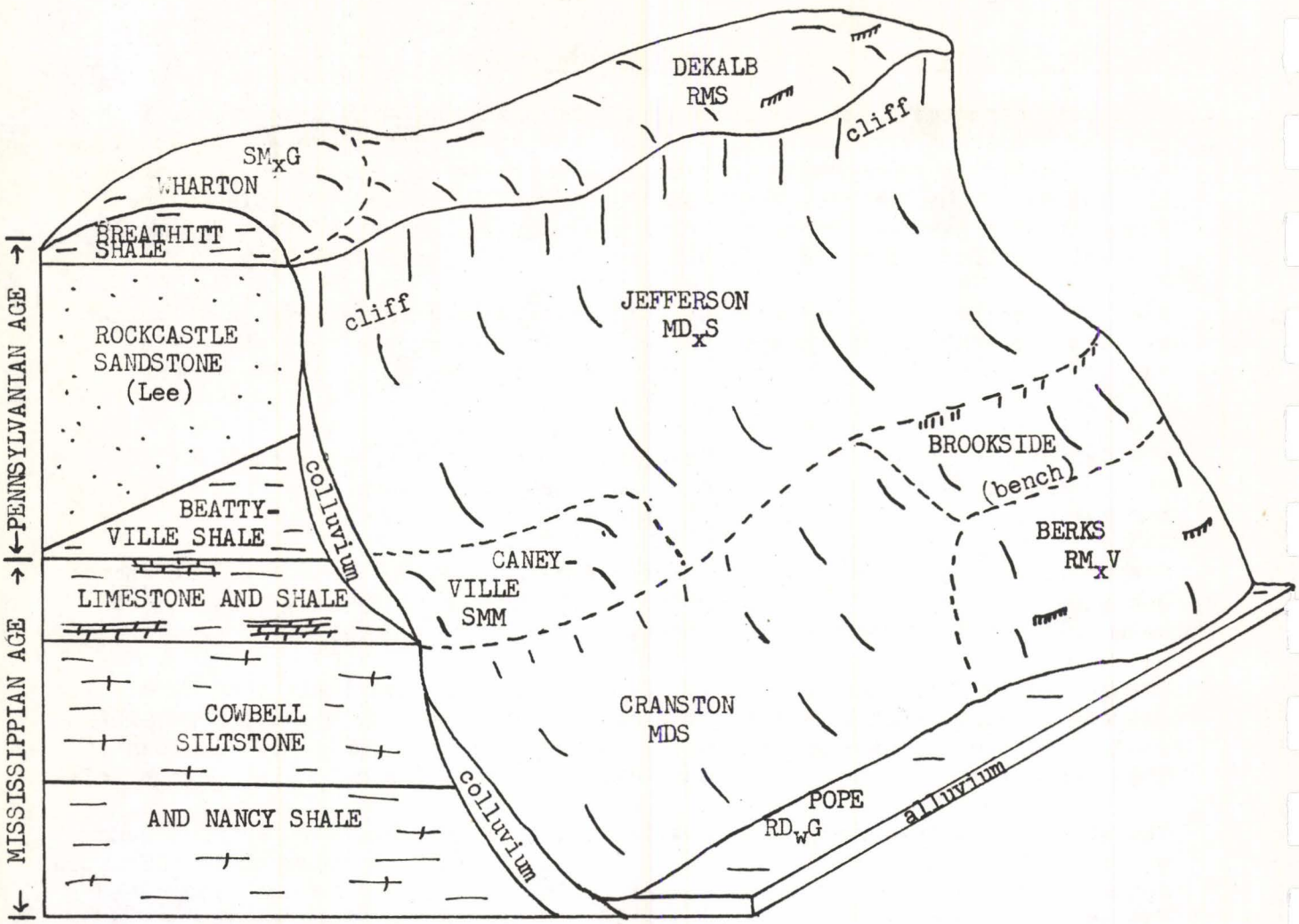
Management Situation

The oak site quality is poor to fair on the Berks and these soils should be bypassed for timber management and left for watershed protection and wildlife management. The Cranston soils have fair to good oak site quality and they should be managed for hardwoods. Some south facing slopes could be managed for hardwood-pine. North facing slopes can be managed for yellow-poplar. The Wharton soils on the ridgetop have a fair oak site quality and should be managed for hardwood or hardwood-pine.

The Wildlife habitat is fair to good in this area for deer, grouse, turkey and squirrel. Ponds and clearings can be established on the ridgetops.

These soils have severe erosion and slump hazards. The Wharton soil on the ridge is clayey and when wet has a very low bearing capacity. The Berks and Cranston soils have severe limitations for most recreation uses. Recreation developments could be placed on the ridgetops that have moderate limitations.

Water storage capacity is medium. Surface runoff is very high and produces sharp fluctuations in stream flows following rain. Streams are nearly dry within a day or two after a heavy rainfall in the summer but generally run continuously during wet months. Springs from lower mountainsides flow after heavy rains.



6. JEFFERSON-CRANSTON-DEKALB SOIL MANAGEMENT AREA

6. Jefferson-Cranston-Dekalb Soil Management Area

This soil management area has a deeply dissected landscape with long benchy, steep stony sideslopes and a large spectacular sandstone cliff. The soils have developed from Mississippian Aged siltstones, shales and limestones and Pennsylvanian Aged sandstones and shales. In some places, the sandstone just caps the ridge. The limestone also forms an intermittent cliff in places but is mostly found as outcrops on the ridge and moderately steep upper sideslopes. Stones and boulders cover 2 to 10 percent of the steep slopes. The major soils are well to somewhat excessively drained, very strongly acid, and low in natural fertility.

The Jefferson soils occupy the steep upper sideslopes under the sandstone cliff or cap and also on the toeslopes. Jefferson is a deep soil with a sandy clay loam subsoil and it makes up about 30 percent of this area.

The Cranston soils occupy the steep lower sideslopes and toeslopes and make up about 25 percent of this area. These are deep soils and have a generally silt loam subsoil with 10 to 35 percent fragments. The Cranston soils are absent in the upper reaches of the large drainages where the sandstone cliff is larger and more continuous.

The Dekalb soils are rocky and occupy the ridgetops and moderately steep short sideslopes above the sandstone cliff and make up about 15 percent of this area. These soils are moderately deep, have a yellowish brown sandy loam subsoil and have developed in sandstone residuum.

The minor soils are the deep Brookside soils from limestone on the benches and the moderately deep Wharton soils from shales and siltstones.

Most of this area is forested but a very small portion of the ridgetops and many toeslopes are farmed. The vegetation is largely yellow poplar, white pine, oaks and some hickories. Hemlock and cove hardwoods are in some deep coves. Ridges are largely yellow pine, chestnut and scarlet oak and hickories.

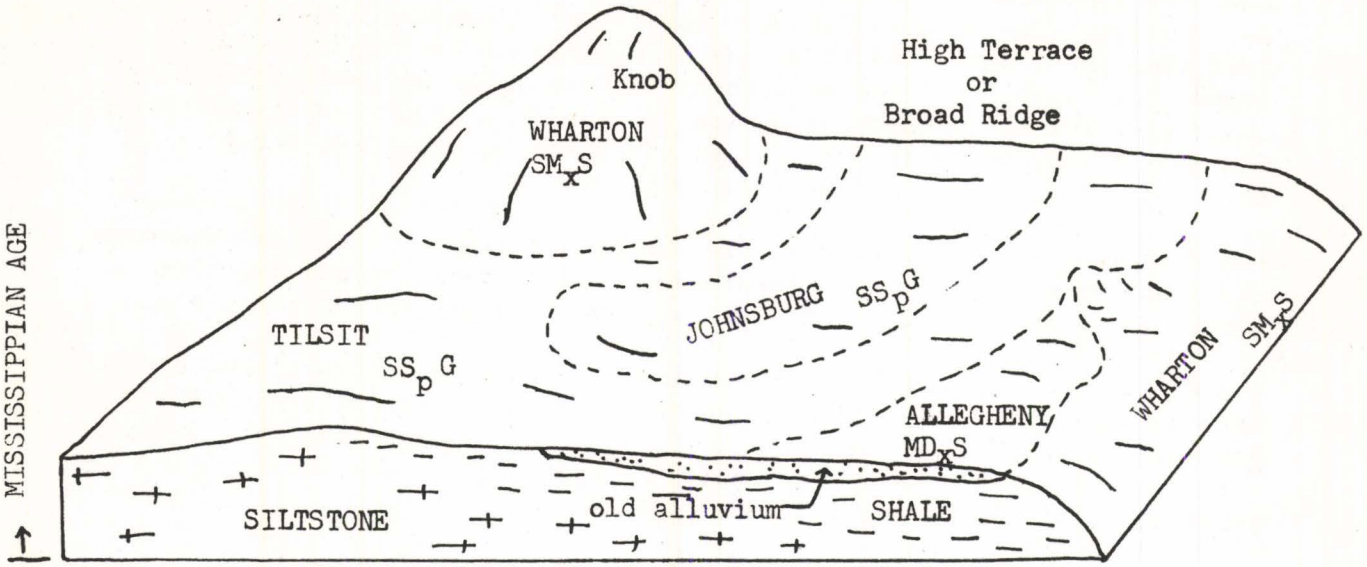
Management Situation

This area has an oak site quality of good on the Jefferson and Cranston soils and poor to fair for the Dekalb soils. Desirable timber should be cove hardwoods, favoring yellow poplar and black oak on the northern aspects. Hardwood-pine can be managed on the southern aspects of upper slopes and pine-hardwood on Dekalb soils.

The wildlife habitat is fair to good in the area for deer, grouse, turkey, and squirrel and the potential is high. Clearings and ponds can be placed on Whitley and Wharton soils.

The major soils have severe slide and erosion hazards and they have severe limitations for most recreation uses. Opportunities for development are best on the toeslopes or terraces.

Streams are continual-flowing even during the dryer months. Water storage capacity is medium to high and surface runoff is moderate. A few sinkholes occur in some streams and springs and wet weather seeps are common near limestone areas.



7. TILSIT-WHARTON-JOHNSBURG SOIL MANAGEMENT AREA

7. Tilsit-Wharton-Johnsburg Soil Management Area

This soil management area is on nearly level to sloping broad ridgetops and high terraces. The soils have developed in old alluvium washed from acid siltstone and shales and in residuum from shales and siltstones. The soils are very strongly acid and low in natural fertility. The drainage of the Tilsit-Wharton-Johnsburg soils are moderately well, well, and somewhat poorly drained, respectively.

The Tilsit soils occupy the gently sloping to sloping areas and they make up 60 percent of this area. Tilsit soils are deep and they are characterized by a hard fragipan which varies in depth from 17 to 26 inches.

The Wharton soils occur on the narrow ridges and knobs above the nearly level areas and the short smooth sideslopes below and skirting the nearly level areas. These soils are moderately deep and have a silty clay subsoil. They make up about 25 percent of this area.

The Johnsburg soils occur on nearly level areas that are slightly concave and they make up about 10 percent of this area. These soils are deep and they are characterized by a fragipan in their silt loam subsoil.

Small portions of Robertsville and Monongahela soils are on the nearly level areas and make up the remaining acreage in this area.

Most of this area is privately owned and farmed. The exception is in the Cave Run Reservoir Area. The cleared land is either in pasture or row crops. Old fields have or are reverting to a pine or pine-oak cover.

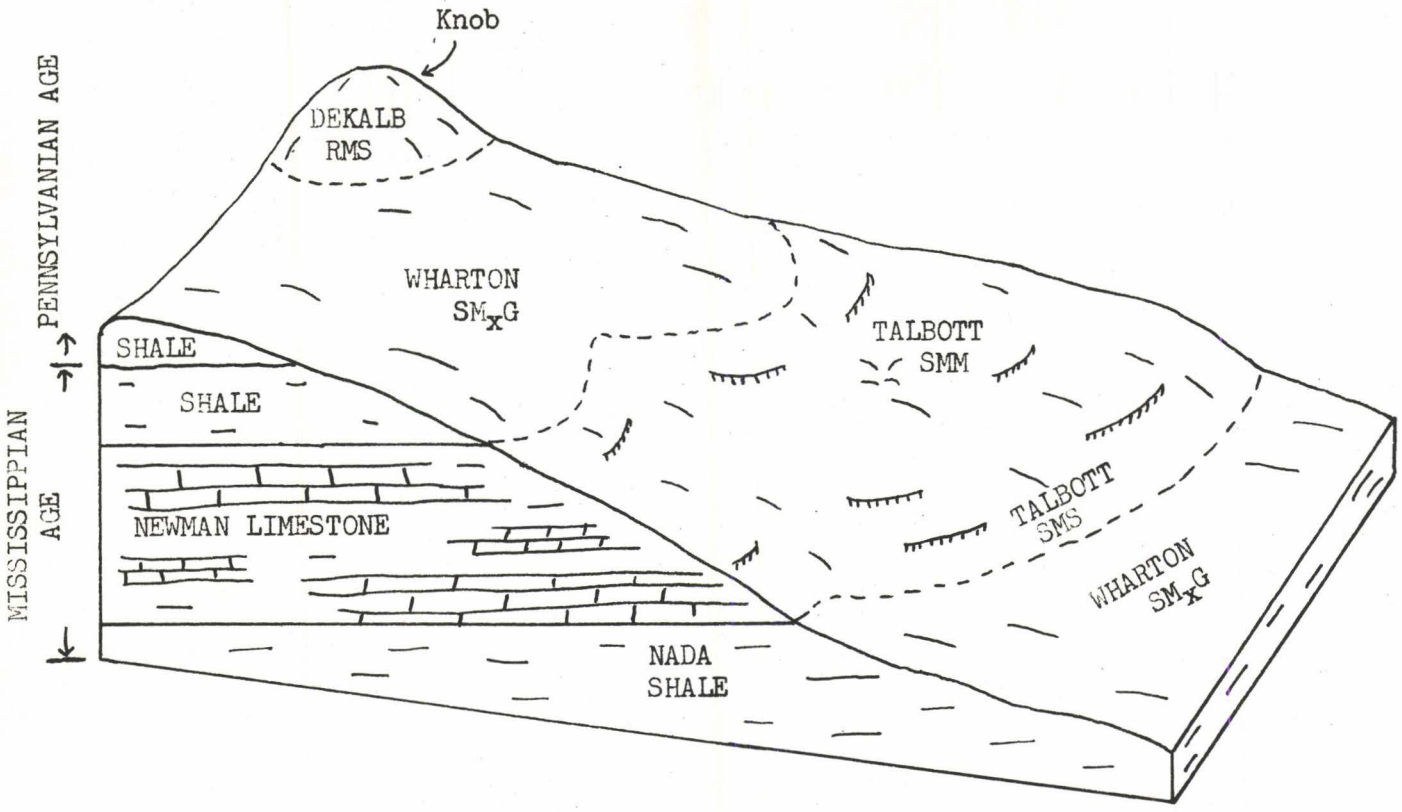
Management Situation

The Tilsit soils have a good oak site quality and should be managed for oaks. The Wharton soils have a fair oak site quality and should favor hardwoods or hardwood-pine. The Johnsburg soils should favor bottomland hardwoods.

The wildlife habitat is good for rabbits and quail because of the open fields, pasture, and corn. Deer and grouse use these areas for food but the lack of cover limits a permanent type deer and grouse habitat.

Limitations are moderate to severe for campsites and picnic areas. The soils have slow permeability and are easily compacted. Construction is limited on the Tilsit and Johnsburg soils due to wetness and a seasonal high water table. Wharton soils are severely erosive.

These soils have a high water storage capacity and medium surface runoff.



8. TALBOTT-WHARTON SOIL MANAGEMENT AREA

8. Talbott-Wharton Soil Management Area

This soil management area is on narrow to broad ridgetops and short moderately steep, upper sideslopes. The major soils have developed in residuum from Mississippian Aged limestone and shales of the Newman and Pennington Formation. The soils are moderately deep and well drained. The Talbott soils are slightly acid and high in natural fertility while the Wharton soils are very strongly acid and low in natural fertility.

The limestone occurs as outcrops on the ridge and steep upper sideslopes. In many places sandstone of the Lee Formation forms a cap on the ridge.

The Talbott soils occupy the ridgetops and moderately steep sideslopes and make up about 50 percent of this area. They are moderately deep, have a red clay subsoil and have developed from limestone. Stones, boulders or rock cover from 10 to 15 percent of the surface.

The Wharton soils have developed from shales and they are on the ridgetops. They are moderately deep, have a silty clay subsoil and make up about 35 percent of this area.

The remaining soils are the moderately deep Clymer and Dekalb soils on knobs and the Tilsit soil on the nearly level portions.

The present vegetation consists of upland oaks, hickories, ash, walnut, red cedar, and pines. Some areas are pastured. Old fields have reverted to yellow pine.

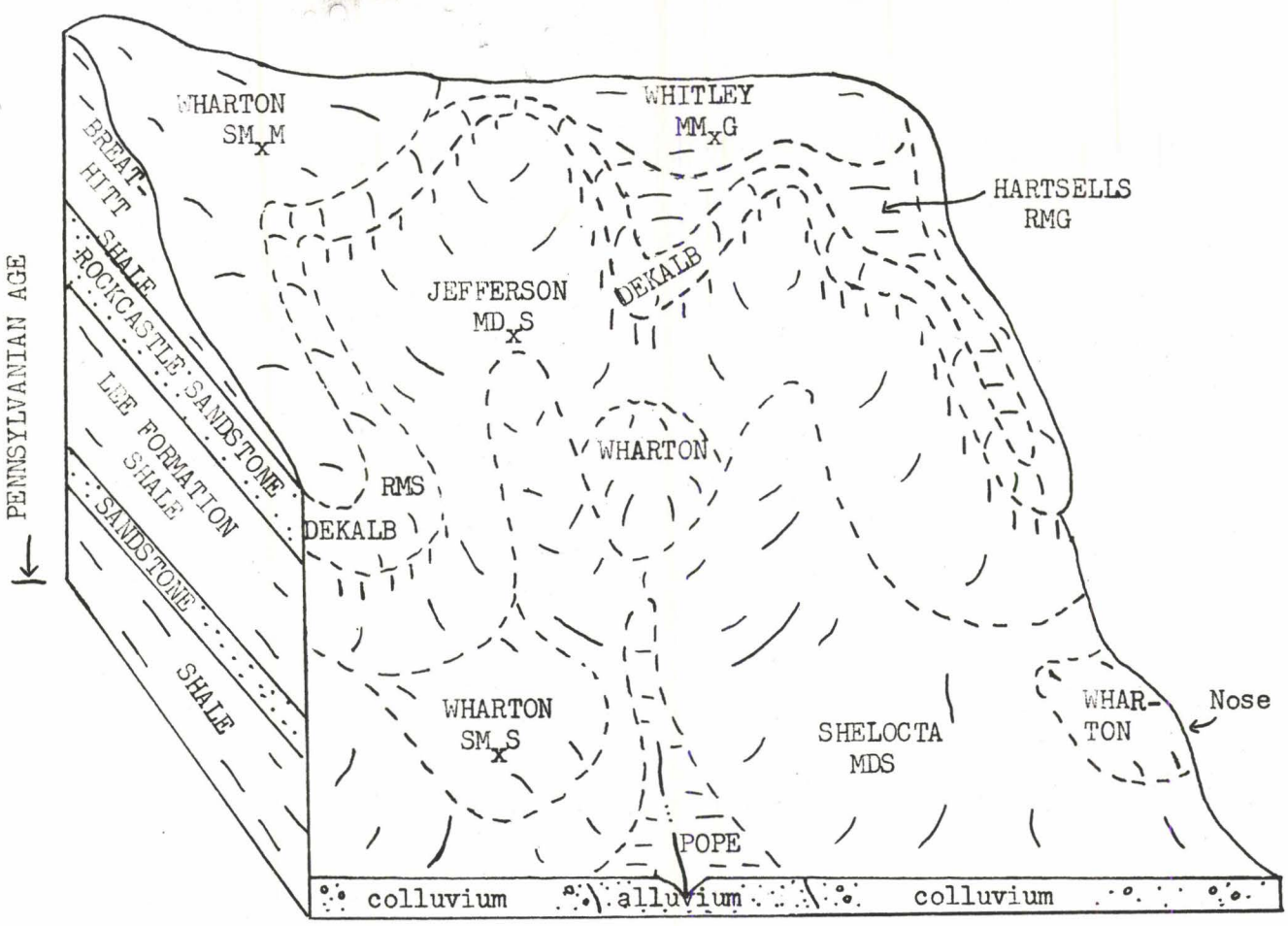
Management Situation

Careful consideration should be taken on any phase of land management on this area because of the severe erosion and compaction hazard. This area has a fair oak site quality and hardwoods should be favored.

The wildlife potential is fair to good in this area for deer, grouse, turkey and squirrel. The area supports a wide variety of trees and shrubs for food and cover. Water impoundments could be built on Wharton or Tilsit soils.

Recreational potential is medium. When wet, these soils have a low bearing capacity for the operation of vehicles or equipment. The surfacing of roads, trails, tent pads and picnic areas will be required.

Streams flow in wet months but go underground during the dry season. Springs and seeps are common during the wet months. The soils have a high water storage capacity and moderately rapid surface runoff.



9. SHELOCTA-JEFFERSON-WHARTON SOIL MANAGEMENT AREA

9. Shelocta-Jefferson-Wharton Soil Management Area

This soil management area consists of rugged topography that includes moderately wide ridges with steep, stony soils below a sandstone cliff. The underlying bedrock is Pennsylvanian Aged acid shales and sandstones of the Lee and Breathitt Formations. The soils are deep to moderately deep, well drained, very strongly acid, and low in natural fertility.

The Shelocta soils occupy concave lower slopes, are deep have a silty clay loam subsoil, and make up about 35 percent of this area.

The Jefferson soils occupy concave upper slopes below the cliffs, are generally stony, are deep, have a clay loam subsoil, and make up about 35 percent of this area.

The Wharton soils occupy ridges, convex sideslopes and noses. They are moderately deep, have a silty clay subsoil and make up about 20 percent of this area.

The remaining 10 percent consists of Dekalb soils on narrow rocky ridges near cliffs and Whitley soils on broad flat ridgetops.

Most of this area is forested. Some broad ridges and bottoms are farmed. The forest cover ranges from hardwood with some pine on the ridgetops and upper south facing slopes to cove hardwoods on lower north facing slopes and coves.

Management Situation

Timber management direction in this area favors hardwoods even on ridges and south facing slopes. Cove hardwoods are favored on north facing slopes particularly the lower slopes. Oak site quality is fair to good area wide.

Wildlife management should favor squirrel, deer and grouse. The habitat is excellent for squirrel and good for deer and grouse. Clearings are best established on Whitley soils and ponds are well suited on Wharton soils.

Road construction on the steep soils should take into account the severe erosion and slump hazards of the soils. Deep cuts should be avoided and adequate drainage to prevent saturating the fill material is necessary.

Recreation potential is limited on Jefferson and Shelocta soils due to the stoniness and steep slopes. Sites can be located on ridgetops of Hartsells and Whitley soils where limitations are slight to moderate. Wharton soils compact and erode easily.

Water storage capacity is high and surface runoff is low to medium. Stream flows are fairly regular the year around except where most of the land is cleared.

B. Timber Use and Management 1/

Harvesting the maximum quantity of high quality logs and products from our forests over a long period of time requires that foresters understand the relationship of soil to site quality and timber management. Scientific silvicultural methods are needed to meet the demands for saw logs in the future. It is only natural to assume that the kind of soil on a particular landform affects the growth rate of different trees, the species composition, and the direction of succession of plant communities.

The particular kind of soil at each site influences forest site quality mainly through its level of fertility and moisture supplying capacity. Many other soil characteristics and qualities such as surface texture, depth to the water table, erosion hazard and rockiness also affect site quality or the use of the land for timber management. Other site factors to be considered in timber interpretations of the soil are aspect and slope position as they affect the moisture supplying capacity of the soil.

Based on their similarity for timber use and management the soils of the Morehead and Stanton Districts were divided into 11 significantly different interpretive groups. Table 1 rates the different interpretive groups for productivity, preferred species and other factors influencing tree growth and management. The following narrative explains the columns in table 1.

(1) (2) Species and site index range: Site index is expressed as tree height in feet at age 50 for all species except cottonwood for which a 30 year base is used. Site index ratings are given in 10 foot classes.

Site index data was gathered from sample plots on representative soils. Insofar as possible, site index trees were dominate stems which had been free from suppression, fire, disease and other damage throughout their lives.

From three to six trees on each plot were measured for age, height, and DBH with a description of the soil, understory vegetation, slope gradient, slope position, stoniness and other site informations recorded for the plot.

After the site index for each tree was determined, a plot average was computed which was used for comparison with other plots with similar soils and trees.

1/ Assistance in preparing this section was provided by Larry Ford, Timber Management Specialist, Daniel Boone National Forest; Richard Bonyata, Ranger, Morehead District; and Bob Brooks, Ranger, Stanton District.

Site index curves recommended for Kentucky by the Northeastern and Southeastern Forest Experiment Stations were used.

Because of current stand conditions, reliable site index data was unobtainable for some soils. Indices for these were interpolated from data for similar soils in the report area or from data obtained on the name soils in other areas of Kentucky.

Soil Groups 6 through 11 are subdivided by aspect and slope position with indices given for the various subdivisions. These groups have dominate slopes of over 20 percent. "N" indicates the lower one-third of slopes on all aspects and the upper two-thirds of slopes with aspects of 340 to 125 degrees. "S" is for ridgetops and the upper two-thirds of slopes with aspects of 125 to 340 degrees.

(3) Average annual growth: Site index can be converted to a volumetric prediction of growth and yield which can be shown in wood measurements such as board feet per acre. Predictions of average yearly growth per acre in board feet international ¼ inch scale, are based on yields developed from stand data in Agriculture Handbook 181, and Technical Bulletin 560, and tree growth data soil-site evaluations. Yearly growth estimates are to age 60 for yellow-poplar and the oaks.

(4) Preferred Species: These are the common desirable species most suited to the site. Individuals of these species should be favored in existing stands. Stands should be regenerated to forest. Type made up of one or a group of these species with the selection depending upon comparative productivity, the existing stand, and current policy.

(5) Suitable Species for Planting and Seeding: This column lists in their order of preference the species suitable for planting. This information is useful when regenerating old fields, burned over areas, or areas with few desirable species. Soils with moderate to severe plant competition ratings may require cultural treatments to release the planted trees.

(6) Plant Competition: This refers to the invasion or growth of undesirable species when openings are made in the tree canopy and indicates site preparation needs and future weedings.

Slight - the early growth of desirable reproduction is essentially unhindered by competing vegetation.
Moderate - the early growth of desirable species will be delayed and some minor cultural treatment would reduce competition.
Severe - competition will prevent adequate natural or artificial regeneration without intensive site preparation and maintenance treatments such as weeding.

(7) Seedling Mortality: Refers to the loss of planted or natural seedlings as a result of frost heaving, improper moisture supply or other site factors and indicates establishment difficulty.

Slight - when establishment of desired species is no problem between 0 and 25 percent mortality.
Moderate - when establishment of the desirable species presents a minor problem. Between 25 and 50 percent mortality.
Severe - Expected mortality is over 50%.

(8) Erosion Hazard: Refers to the inherent susceptibility of the soil to be moved primarily by water without consideration of the ground cover. This rating is important when planning site preparation logging methods and road networks.

Slight - presents only minor problems with management operations curtailed only during extremely wet periods.
Moderate - requires special consideration to keep high use areas dry and to reduce concentration of water.
Severe - requires detailed management planning to reduce the effect of surface disturbance and the resultant erosion.

(9) Equipment Limitations: Refers to the relative degree that wheel and track laying equipment is restricted. Such restrictions would be slope, surface texture, stones, cliffs, wetness, etc.

Slight - equipment use is not restricted to kind or time of year.
Moderate - equipment is somewhat restricted as to kind or operations by one or more of the above mentioned factors.
Severe - there is a restriction as to the kind of equipment and/or season of year by one or more of the above factors.

Table 1 Soil Factors Influencing Timber Growth and Management

Group Number with included soil mapping units	General Soil Description	Productivity Potential: Species (1)	Site Index Range (2)	Average Annual Growth bd. ft./ac. (3) [1/]	Preferred Species (4)	Suitable Species for Planting and Seeding (5)	Plant Competition (6)	Seedling Mortality (7)	Erosion Hazard (8)	Equipment Limitation (9)
1 191; 184; 185; 112; 46B1; 47B1; 480; 390; 387A	Poorly and somewhat poorly drained soils developed in alluvium. Soils either flood or pond water.	Sweet Gum Cottonwood Pin Oak	95+ 95+ 95+	500+ 570+ 450+	Sweet Gum Cottonwood Sycamore; Pin Oak. Yellow Poplar on better drained portions.	Sweet Gum Cottonwood Sycamore Pin Oak	Severe	Moderate to Severe	Slight	Severe
2 133;180; 181A, A2; 297; 237; 380A1, B1; 379A1; B1; 377B1; C1; 339B1; 335B1, C1, D1; 376B1, C1, D1; 490B1, C1, D1; 793C1; 44B1, 332B1, C1, 40B1, C1, D1	Well drained soils on bottoms, low terraces, alluvial fans, and toeslopes.	Yellow poplar Upland oak White pine	95+ 75-85 85+ on first bottoms 80-90	495+ 240-350	Yellow poplar, n.r. oak, black oak, white oak, black walnut, white pine	Yellow poplar, white pine, black walnut, shortleaf pine, n.r. oak, black locust	Severe	Slight	Slight	Slight
3 86B1, C1; 383B1, C1	Moderately well drained soils with fragipans on high terraces and broad ridges.	Upland oak Shortleaf pine Yellow poplar	65-75 65-75 80-90	150-240 540-670 330-440	Shortleaf pine, black oak, scarlet oak, n. r. oak. Yellow poplar on toeslopes or protected areas.	White pine and shortleaf pine.	Moderate	Slight	Slight	Slight
4 864B1, C1, D1; 83C1; D1; 805B1, C1, D1; 80C1, D1; 836C1	Moderately deep, well drained soils on ridgetops developed from siltstone, shale and sandstone.	Upland oak Shortleaf pine	55-65 65-75	90-150 560-670	Scarlet oak, shortleaf pine, chestnut oak. Also black oak on 83C1, D1	Shortleaf pine and Virginia pine	Moderate; slight on Dekalb soils	Slight; moderate on Dekalb soils.	Slight	Slight
5 892C1, D1; 803C1, D1; 821D1, D3; 332D1; 825C1, D1; 882C1, D1; 438D1	Clayey, moderately deep to deep soils on ridges and toeslopes.	Shortleaf pine Upland oak	65-75 65-75	540-670 150-240	White oak, scarlet oak, shortleaf pine, black oak, white oak	Shortleaf pine, and Virginia pine, white pine	Moderate	Slight (moderate on exposed slopes)	Moderate to Severe	Moderate to Severe
6 892E1; 882E1; 438E1, F1; 813F1; 332E1; 80E1, E3; 864E1; 81E1, E3; 840F1, F3, G1; 867F1; 883E1, F1	Moderately steep to steep sloping soils on side slopes.	Upland oak Upland oak	[2/] N 75-85 [3/] S 65-75	240-350 150-240	White oak, scarlet oak, black oak, shortleaf pine, yellow poplar,[2/] red oak,[2/] white pine.	Shortleaf pine, and Virginia pine, white pine	Moderate to Severe	Slight (moderate on exposed slopes)	Very severe	Severe
7 707C1, E1; 704C1; 725C1, C2, D2	Moderately deep, rocky soils high in clay content that have developed from limestone	Upland oak Shortleaf pine	65-75 65-75	150-240 540-670	White oak, scarlet oak, black oak, white ash, [2/] black walnut.[2/]	Shortleaf pine, Virginia pine, [2/] black walnut[2/]	Moderate	Slight (moderate on exposed slopes)	Severe	Severe
8 444F1; 723E1, F1, G1	Deep, clayey soils on steep slopes that have developed in colluvium from limestone.	Yellow poplar Upland oak Upland oak	95+ [2/] N 75-85 [3/] S 65-75	495+ 240-350 150-240	Yellow poplar, black oak, n.r.oak, white oak, white ash, buckeye, black walnut, white pine	Yellow poplar, white pine, black walnut, red oak.	Severe	Slight	Very severe	Severe
9 41E1, F1; 43F1; 793E1, F1; 725E1, E3, F1; 492F1	Steep soils developed in deep sandy colluvium generally below sandstone cliffs. Most soils are moderately coarse textured but some are fine textured.	Upland oak Upland oak Yellow poplar White pine	[2/] N 75-85 [3/] S 65-75 [2/] N 95+ 85-95	240-350 150-240 495+	White oak, black oak, yellow poplar[2/] shortleaf pine, white pine, n.r.oak, scarlet oak.	Shortleaf pine, white pine, yellow poplar, red oak	Moderate	Slight	Severe	Severe
10 490E1, F1; 842E1, F1	Steep soils developed in deep gravelly and silty colluvium.	Upland oak Upland oak Yellow poplar Shortleaf pine	[2/] N 70-80 [3/] S 60-70 [2/] N 95+ 65-75	200-290 120-190 495+ 540-670	Scarlet oak,[3/] Black oak,[2/] white oak, yellow poplar,[2/] chestnut oak.[3/]	Shortleaf pine, white pine, yellow poplar.[2/]	Moderate	Slight	Severe	Severe
11 857C1, D1, E1; 878G1; 011	Moderately deep soils on ridges and upper side slopes.	Shortleaf pine Chestnut oak Virginia pine	55-65 [2/] N 55-65 [3/] S 45-55 55-65	420-540 90-150 50-90 370-450	Chestnut oak, Virginia pine, shortleaf pine	Virginia pine and shortleaf pine.	Slight	Moderate to Severe	Moderate to Severe	Severe

1/ Based on site index. See explanation on preceding pages.
2/ The lower one-third of slopes on all aspects and the upper two-thirds of slopes that have aspects of 340 to 125 degrees.
3/ On ridgetops and upper two-thirds of slopes with aspects 125° to 340°.

C. Water Behavior and Management 1/

The importance of the water resource is increased by the many miles of streams and proposed reservoirs that are or will be used for water supply and recreation. Mining, road building, cultivating steep slopes and stream bank erosion are the major sources of siltation and other pollution. General statements about watershed management are made in the descriptions of each Soil Management Area in section A of Soil Use and Management. In this section detailed information is in table 2, Rating of Factors Significant to Water Management. This table contains fifteen (15) soil groups that have different water behavior characteristics. The soils combined in each group are similar in the general characteristics important to water behavior and management. The following narrative explains each column listed in the table.

(1) Hydrologic Soil Units:
The soil series and consequently the soil mapping units were arranged into fifteen (15) Water Groups or Generalized Hydrologic Soil Units. Each soil in a particular complex or group will, with some variability, fit the generalized ratings for each factor. There are three (3) major soil characteristics that affect water behavior in any given area. These are permeability, depth and slope.

A. Permeability is the rate of water percolation in inches per hour. The first letter in the complex indicates the permeability.

Permeability Class	Rate in./hr.	In./24 hrs.
(S) Slowly	.063-0.63	2-3
(M) Moderately	.63-2.0	2-6
(R) Readily	2.0-6.3	6
(X) Excessively	6.3-10.0	6+

B. Depth - The second letter refers to hydrologic depth of the soil or depth to an impeding layer such as rock, water table, fragipan, or impermeable clay or gravel layer. Subscripts to the depth letter indicate kind of impeding layer. A subscript (w) is used on the depth to denote a water table as the impeding layer, or on deep classes that a water table is within five (5) feet of the surface. A subscript (p) indicates a fragipan as the limiting layer. A subscript (x) indicates that the lower part of the permeable layer is mostly fractured rock with little fine material to hold water. This fractured rock may hold and transmit some water at certain times and is worthy of note. The absence of a subscript means that rather hard bedrock is the impeding layer.

1/ Assistance in preparing this section was provided by Robert Tobiaski, Watershed Specialist, Daniel Boone National Forest.

Depth Class	Depth Inches	Subclasses of Depth
(S) Shallow	12"	(X) Fractured rock or shale
(M) Medium	12-36"	(P) Fragipan between 0-36"
(D) Deep	36-72"	(W) Water table within 5' of surface
(V) Very deep	72"+	

C. Slope - The third letter indicates the percent gradient. Slope strongly affects water behavior on the site.

Slope Class	Percent
(G) Gentle	0-12%
(M) Moderate	12-30%
(S) Steep	30-50%
(V) Very steep	50-70%
(X) Excessively steep	70%+

(2) Dominant Slope:
This is the dominant slope measured on the landscape for the soil mapping units in each soil group.

(3) Slope length:
This is based on soil mapping unit size. Measurements were made on aerial photographs and topographic maps.

(4) Dominant Humus Type:
The humus types are defined by Trimble and Lull, Station paper No. 85, Northeast Forest Experiment Station, 1956. For all practical purposes actual H layers are non-existent in this area as organic matter becomes well decomposed and colloidal it is mixed into the A1 horizon by microbes, worms, and animals. Consequently, the humus types are Mulls which have the L and F layers with A1 horizons a mixture of organic matter and mineral matter. Farmed areas are generally in a grass cover and have little or no Humus type. The Humus types that occur in this area are defined below.

Medium Mull - The A1 horizon has medium granular structure-granules about 2 mm in size. Organic matter content of the A1 ranges from 5 to about 30 percent.

Deep medium mull - combined L and F layers are less than 2 inches thick.

Sand Mull - The A1 horizons are single grain with no evident structure or granules. Organic matter is more or less evenly distributed throughout the sandy A1 horizon.

Shallow sand mull - combined L and F layers are more than 1½ inches thick.

Deep sand mull - combined L and F layers are more than 1½ inches thick.

(5) Erosion Hazard: This is a relative rating that refers to the inherent erosion hazard of the bare surface. Surface texture and slope are important characteristics considered in this estimate.

(6) Surface Runoff Potential: Refers to the relative amounts of water that can run off the surface of the soil and enter the stream. A March and August rating are given in an attempt to consider antecedent soil moisture; M-March, A-August.

(7) Water Storage Capacity: Refers to the relative amounts of water a soil can hold within its effective depth. Group one soils are deep to bedrock but shallow to water table. Therefore, only 10 inches of soil is available to store water. Depth, Pore Space, which is a function of texture, and organic matter are the main factors that affect total storage capacity. The ability of a soil to hold moisture increases with increasing soil depth and increasing contents of silt, clay, and organic matter.

(8) Subsurface Runoff: Refers to the gravitational water that moves through the soil to contribute to stream flow. Fine textured soils retain more moisture and have lower yields than rapidly permeable coarse textured soils.

(9) Slump and Slide Hazard: Indicates the susceptibility of the soil to slump or slide when cut for roads or other purposes, fine textured soils on steep slopes receive and retain more moisture and slump more easily than fine or medium textured soils on gentle slopes.

(10) Effective Depth: Refers to the hydrologic depth of the soil which is the approximate depth in inches from the surface to an impeding layer such as a fragipan, water table, or rock. For example Tilsit soil is over 4 feet to bedrock but has a fragipan at about 24" and therefore the effective depth of the soil is 24".

Table 2 Rating of Soil Section Factors Significant to Water Management

Group Number	Water Group	Average 1/ Hydrologic Soil Units (1)	Dominant Slope Percent 2/ (2)	Dominant Slope Length (Yards) (3)	Dominant Humus Type 3/ (4)	Erosion Hazard (5)	Surface Runoff Potential (6)	Potential 4/ Water Storage Capacity (7)	Sub 4/ Surface Runoff Potential (8)	Slump and Slide Hazard (9)	Effective Depth (Inches) (10)
1											
184; 191; 112; 390; 480; 185; 46B1; 47B1; 286	Poorly and somewhat poorly drained medium textured soils of the bottoms and low terraces that flood or pond nearly every year.	MS_wG	2	20	farmed	slight	M-high A-low	low	medium	slight	10 to 20" (water table)
2											
133; 297; 237; 180; 181A, A2; 16A, C; 10A, C; 116A	Well drained moderately coarse to medium textured soils of the bottoms that flood nearly every year. (Water table generally at 5 feet).	RD_wG	2	20	farmed or deep medium mull	slight	M-med A-low	low (mostly coarse texture)	medium	slight	60"+
3											
380A1, B1; 339B1; 335B1, C1, D1; 490B1, C1, D1; 376 B1, C1, C1; 41B1, C1, D1; 377B1, C1; 379A1, B1; 332B1, C1	Well drained medium textured soils of low terraces, toeslopes and alluvial fans. Some terraces and fans flood about 1 out of 10 years.	RDG-RVG	4 to 8	50	farmed or deep medium mull	slight to moderate	M-med A-low	high (deep)	low (retained)	slight	72"+
4											
383B1, C1; 86B1, C1; 387A	Medium textured upland and high terrace soils with fragipans.	SM_pG	4	50	farmed or deep medium mull	slight	M-high A-low	low	medium (retained)	slight	24"
5											
707C1, E1; 704C1; 725C1, C2, D2	Moderately deep fine textured soils overlying limestone. Often rocky.	SMM	18	50	shallow medium mull	very severe	M-high A-high	medium (depth)	low	severe	36"
6											
793C1, E1; 725D1, D3, E1, E3	Deep moderately coarse to fine textured soils overlying limestone and shale.	MD_xM and SMM	22	100	deep sand mull	severe	M-med A-med	high	medium	severe	60"+

Table 2 Rating of Soil Section Factors Significant to Water Management , Cont'd.

Group Number	Water Group	Average 1/ Hydrologic Soil Units (1)	Dominant Slope Percent 2/ (2)	Dominant Slope Length (Yards) (3)	Dominant Humus Type 3/ (4)	Erosion Hazard (5)	Surface Runoff Potential (6)	Potential 4/ Water Storage Capacity (7)	Sub 4/ Surface Runoff Potential (8)	Slump and Slide Hazard (9)	Effective Depth (Inches) (10)
7											
892C1; 882C1; 803C1; 825C1	Moderately deep fine textured soils overlying shale.	SM G	8	50	shallow medium mull	moderate	M-high A-medium	medium to high (broken shale rock)	low	severe	36"+
8											
892D1; D3; 882D1; 803D1; 825D1; 821D1, D3; 892E1; 882E1; 864E1; 842E1; 81E1, E3, 883E1; 332D1, E1; 438D1, E1	Moderately deep fine textured soils overlying shale.	SM_XM	22	75	shallow medium mull	moderate	M- high A- medium	medium to high (broken shale rock)	low	severe	36"+
9											
490, E1, F1	Medium textured gravelly soils overlying silt-stone and shale.	MD_XS	40	250	shallow medium mull	severe	M-high A-high-med	medium	medium	severe	60"
10											
857C1; 836C; 805B1, C1	Moderately coarse textured soils overlying sand-stone on ridgetops.	RMG	10	50	shallow sand mull	slight	M-low A-low	low	low	slight	30"
11											
857D1, E1; 805D1; 836D1	Moderately coarse textured soils overlying sand-stone. Often rocky.	RMS	30	100	shallow sand mull	severe	M-low A-low	low	high	slight	36"
12											
864B1, C1, D1; 83 C1, D1; 80 C1, D1	Medium textured soils overlying shale and silt-stone.	MM_XM	8	50	farmed or deep medium mull	slight to moderate	M-med A-low	high	low	moderate	40"

Table 2 Rating of Soil Section Factors Significant to Water Management, Cont'd.

Group Number	Water Group	Average 1/ Hydrologic Soil Units (1)	Dominant Slope Percent 2/ (2)	Dominant Slope Length (Yards) (3)	Dominant Humes Type 3/ (4)	Erosion Hazard (5)	Surface Runoff Potential (6)	Potential 4/ Water Storage Capacity (7)	Sub 4/ Surface Runoff Potential (8)	Slump and Slide Hazard (9)	Effective Depth (Inches) (10)
13											
41El, Fl; 43Fl; 793Fl; 725Fl; 492Fl	Moderately coarse to medium textured soils overlying siltstone and shale.	RD_xS	40	250	deep medium mull	severe	M-low A-low	high	low	severe	60"
14											
813Fl; 438Fl; 444Fl; 867Fl; 842Fl; 840Fl, F3, Gl; 883Fl	Moderately fine to fine textured soils overlying shale, siltstone and limestone.	SD_xS	45	250	shallow to deep medium mull	very severe	M-high A-med	high	low	very severe	60"
15											
878Gl	Moderately deep medium textured soils overlying siltstone.	RM_xV	60	200	shallow medium mull	very severe	M-very high A-high	low	high	severe	36"

1/ The precise HSU for each soil is given in the appendix of this report.
2/ The slope range for each soil mapping unit is given in Part II Description of The Soils.
3/ Generalized types are given. Humus types depend on land use.
4/ In the Engineering Section permeability is given in inches per hour, available moisture in inches per inch, and tables 3 and 4 estimate bulk density in grams per cubic centimeter that are needed for making soil moisture calculations.

GENERAL DISCUSSION OF WATER BEHAVIOR ON THE DISTRICTS

The soils, climate, landform, geology, and landuse affect water behavior and the following discussion is intended to briefly acquaint the reader with those factors and their relationships.

Soil texture, water tables, coarse fragments, porosity, fragipans, soil structure, soil consistence and soil depth are some of the important soil features that affect infiltration, permeability, and water storage in the soils. A very deep, well drained, friable, loam soil with good soil structure, no coarse fragments, gentle slope, and adequate vegetative cover would be ideal for receiving, transmitting and storing water. Most soils do not have most of these desirable characteristics and this is reflected in the rapid runoff from a watershed.

Many of the steep soils on the lower half of hillsides throughout the area have developed in deep colluvium which contributes to the water storage capacity of the watersheds. Soils on upper slopes and ridges are generally shallower to bedrock and store less water. Many soils have high percentages of coarse fragments which reduce storage capacity and tend to increase the permeability rate. Table 2 incorporates the effects of the important soil features in rating site factors important to water management.

A knowledge of the climate is helpful in water management.. The average January and July temperature for Farmers, Kentucky are 36°F and 75°F respectively. The growing season is about 180 days and the average annual precipitation is about 46 inches. The area has not wet or dry seasons. In some months, however, rainfall is either inadequate or excessive. Generally, July receives the most rain with an average of 5.04 inches and October receives the least rainfall with an average of 2.10 inches. The annual highest intensity storm will occur in July about 30% of the time. The other 70% of the time, the annual high intensity storm occurs at a decreasing probability rate from July to November, and at an increasing rate from February to July. For detailed information on precipitation, temperature and storm intensity data, refer to the Watershed Analysis of the Morehead District. The climate section of this report lists some weather data from the Farmers, Kentucky station.

There are four general kind of rocks in the area; shale, siltstone, sandstone and limestone. Shale and siltstone bedrock can store and transmit only small amounts of water, but this capacity depends upon the degree of weathering and fracturing of the rock. Sandstone, as a rule, can store very little water, but transmits through cracks and between beds in varying amounts depending on the degree of fracturing. Limestone can store and transmit water in caverns and solution channels.

The stream pattern is dendritic throughout the area. The drainage density remains fairly constant throughout the area, but varies locally with the irregularities in the thickness of different layers of rock and with relief.

The vegetal cover and land use affects water behavior. Most of the area is thickly forested and the soils are in fair to good hydrologic condition. Even so, surface runoff is high in much of the area and is created mainly by steepness of slope and/or shallowness of the dominant soils. The surface runoff would be much greater if the area weren't forested. The generally thick litter layer tends to restrict surface runoff by providing ready infiltration of water into the soil, but on very steep slopes where the litter is slightly compacted, a shingle effect on the soil and the effects of gravity increase the surface runoff.

Road, pipeline, dwelling construction, etc., affects the water behavior in a watershed by altering the soil and thereby reducing storage and increasing runoff and pollution. Harmful effects of construction can be reduced considerably by good soil management.

Tables 3 and 4 on the next page give some general relationships between soil texture, bulk density, pore space, permeability, etc. Also listed is a formula for determining pore space in a particular soil layer or profile. The size of pores in a soil is related to soil structure and soil particle size. The pore spaces will be large if the soil particles are large and if the soil is well aggregated.

Table 3 - Diagrammatic Presentation of Some Average Weights and Moisture Properties of Soils[1/]

Soil Texture	Particle Density (solids)	Bulk Density gr/cc	Average Total Pore Space (percent)	Pounds per Cubic Foot	Drainage (inches	Avail-able to Plants	Unavail-able	Probable Permea-bility
Coarse Textured	2.6	1.38	38	98	2.7	0.8	1.2	Very good
Medium Textured	2.6	1.28	42	80	2.8	2.3	1.4	Good
Fine Textured	2.6	1.37	44	75	1.5	2.8	3.0	Fair to Poor

Table 4 - Average Soil Bulk Density and Volume of Big Pores for Textural Classes and Land Use Categories[2/]

	Surface Soil		Subsoil			Surface Soil	
Soil Texture	Bulk Density	Percent Volume Big Pores	Bulk Density	Percent Volume Big Pores	Land Use	Bulk Density	Percent Volume Big Pores
Sand	1.40	30	1.49	31	Forest	1.12	1
Loamy sand	1.32	17	1.44	9	Old Fields	1.31	13
Sandy loam	1.36	16	1.42	14	Pasture	1.27	9
Sandy clay loam	1.35	22	1.36	22			
Loam	1.24	19	1.38	11			
Silt loam	1.20	17	1.39	9			
Silty clay loam	1.30	12	1.38	8			
Clay loam	1.40	6	1.50	9			
Silty clay	1.31	10	1.46	4			
Clay	1.28	23	1.44	5			

$$\text{Percent total Porosity} = \left(1 - \frac{\text{Bulk Density or g/cm.}^3}{2.65 \text{ g/cm.}^3}\right) \times 100$$

1/ Forest Service Handbook on Soils, page 147.
2/ Broadfoot and Burke, Soil Moisture Constants and Their Variation, Occasional Paper 166, 1958.

D. Recreation Use and Management 1/

The proper location, design and maintenance of outdoor recreation areas are important considerations of the forest land manager. Utilization of information on the limitations and characteristics of the soils at recreation sites is basic to economic land management. By using a soil map and the information contained in this section, the land manager can select suitable sites for specific facilities and become aware of the soil limitations and how they can be overcome.

The various soil mapping units on the Districts were divided into 12 recreation interpretive soil groups that are quite different in soil characteristics and limitations for recreation use. Each soil group is rated by degree of limitations for the different facilities in table 5 and for selected soil related factors in table 6. The soil maps were made on aerial photographs with a scale of four inches equal one mile or one inch equals 1320 feet. These small scale maps may not give sufficient detail for the design of a specific recreation area. In these instances where a higher intensity map is needed, the Forest Supervisor or District Ranger should make a request for such a service to the Regional Office. The small scale soil maps, on file at the R. D. and S. O. are best used for general planning such as site selection. If for some reason a high intensity map can not be made available, then the small scale soil map (4"=1 mile) on file at the R. D. and S. O. , should be used. The soil lines can be transferred to a large scale topographic map (1"=200' or 1"=400') and the soil map can then be conveniently used for specific design of facilities at a particular proposed recreation site. It should be noted that the small scale map would not be as accurate as the high intensity map.

Table five (5) rates the soils for some of the potential uses at recreation sites. These ratings synthesize the information in table 4 and other physical properties important to engineering practices. The primary factors considered in these ratings are depth to water table, flood hazard, permeability, slope, surface soil texture, coarse fragments and depth to rock. Other primary and secondary factors considered are mentioned for the particular use. The soil mapping units are rated according to three limitation classes. Generally speaking these ratings have the following meanings:

1/ Assistance in preparing this section was provided by Vern Orndorf and Duane Strock, Landscape Architects, Daniel Boone National Forest.

1. Slight soil limitations - The soils are relatively free of limitations that affect the particular use or the limitations are easy to overcome.
2. Moderate soil limitations - The soils have one or more natural limitations of a moderate degree resulting from wetness, slow permeability, etc. Generally, the limitations can be overcome with good planning, careful designs and proper maintenance management.
3. Severe soil limitations - These soils have natural limitations of a severe degree resulting from a high water table, steep stony slopes, flooding, etc. Soils with a severe rating make the use of the soil questionable for the proposed use. Extra careful planning, design, and management are necessary. A severe rating does not mean that it cannot be used. Soils that are to be used for a particular facility regardless of a moderate or severe rating should have management recommendations from a soil scientist.

The limitation ratings for each use are briefly defined in terms of what that rating means in relation to its use.

(1) Permanent Buildings includes service buildings with 3 stories or less and with basements. Buildings without basements would be less affected by some characteristics such as a high water table.

Slight means that the foundation will be stable and maintenance problems will be at a minimum.

Moderate means that a seasonal high water table may cause seepage into basements, or slopes are over 8 percent, or shrink-swell or frost action potentials are medium. Some limitations exist, that if not taken into consideration, might make the foundation unstable.

Severe means that the soil floods frequently, or water ponds on the surface, or shrink-swell or frost action potentials are high. Factors such as these can cause the foundation to shift and be unstable.

(2) Picnic and Play Areas with extensive use.

Slight means that the soil can withstand compaction without detrimental effects for several use seasons. Grass sod can be established and maintained with good cultural practices.

Moderate means that the soil will compact in a few seasons or that slopes are over 6 percent. There will be some difficulty in establishing and maintaining a grass sod using good cultural practices.

Severe means that the soil will compact or erode rather quickly, or the water is often ponded on the surface, or slopes are over 12 percent.

If these areas are to be used, special design or very limited use during peak load periods will be necessary. A grass sod is difficult to establish and maintain.

(3) Hiking Trails on the natural soil surface.

Slight means that compaction or erosion will not be a problem for several seasons.

Moderate means that compaction or erosion will cause soil deterioration in a few seasons because of surface soil texture, wetness, etc.

Severe means that compaction will cause soil deterioration in one or two seasons, or disturbance will cause soil erosion on steeper slopes.

(4) Camp Sites includes tent and trailer sites. Slope is more restrictive on trailer than tent areas.

Slight means that compaction will not be a problem for several seasons. Flooding may occur less than once in five years.

Moderate means that ponding of water may occur, compaction may cause soil deterioration in a few seasons, and/or slopes are of a limiting gradient.

Severe means that the soil floods frequently, slopes are steep, water is ponded on the surface frequently from other than flooding, and/or compaction or erosion will cause soil deterioration in one or two seasons.

(5) Parking Lots are considered to be hard surfaced of usual subdivision design. Slopes are very restrictive.

Slight means that with normal design the soil will support the traffic, slopes are not restrictive, and/or erosion on cuts will be at a minimum.

Moderate means that the bearing capacity is medium because of the shrink-swell potentials or depth to water table, and/or slopes over 2 percent but less than 6 percent.

Severe means that the bearing capacity is low, or the slopes are over 6 percent, and/or the erosion hazard of cuts and fills is severe.

(6) Boat Ramps and Beach Development ratings were combined because they both seem dependent upon similar soil characteristics at the shoreline. Boat ramps are considered to be surfaced with asphalt and beaches with clean sand.

Slight means that a minimum of preparation is necessary before surfacing. Soil is well drained and readily permeable.

Moderate means that the existing landscape will have to be changed somewhat by grading before surfacing or the soil is not readily permeable.

Severe means that a great deal of fill will be needed or slopes are over 12% and the area would have to be changed considerably before it could be surfaced. The soils have a high water table or have a severe erosion hazard.

(7) Access Roads considered are hard surface of the design normally used for county traffic.

Slight means that the soil has a high bearing capacity for supporting moving vehicles, and maintenance, including cuts and fills, will not be a problem.

Moderate means the bearing capacity is medium and/or some erosion or slumps can be expected from cuts and fills.

Severe means the bearing capacity is low and/or slump and erosion hazards will be a problem. Construction and maintenance will probably be costly.

Interpretive Group	Permanent Buildings (1)	Picnic and Play Areas (2)	Hiking Trails (3)	Campsites (4)	Parking Lots (5)	Boat Ramp and Beach Development (6)	Access Roads (7)
1							
878G1; 438E1, F1; 444F1; 490E1, F1; 857D1, E1; 813F1; 707C1, E1; 41 E1, F1; 43F1; 793E1, F1; 892E1; 882E1; 723E1, F1, G1; 704C1; 725C1, C2, D2, E1, E3, F1; 80E1, E3; 864E1; 842E1, F1; 011; 492F1; 81E1, E3; 840F1; 867F1; 883E1, F1; 332E1	Severe Sl, E, Dr	Severe Sl, E, C	Severe Sl, St	Severe Sl, St, E, C	Severe Sl, E, St	Severe Sl, E	Severe St, E
2							
191, 390, 112	Severe Wt, Fl	Severe Wt, C	Severe Wt, C	Severe Wt, C	Severe Wt	Severe Wt	Severe Wt
3							
490D1; 332D1; 438D1; 376D1; 41D1; 793C1; 725D1, D3; 40D1; 842D3	Moderate Sl, E	Severe Sl, E	Slight	Severe C, E	Severe E	Moderate E	Moderate E
4							
805D1; 864D1; 892D1; 80D1; 803D1; 821D1, D3; 825D1; 83D1	Moderate Dr, Sl	Severe Sl, E	Slight	Severe C, E	Severe E	Severe E, Dr	Moderate E, Dr
5							
387A; 184; 185; 286; 480; 46B1; 47B1	Severe Wt, Fl	Moderate Wt, C	Moderate Wt, C	Moderate Wt, C	Moderate Wt	Severe Wt	Moderate Wt
6							
383B1, C1; 86B1, C1	Moderate Wt, Fp	Slight	Slight	Moderate Wt, Fp, Perm (S)	Moderate Fp, Perm (S)	Moderate Wt, Fp, Perm (S)	Moderate Wt, Fp
7							
864B1, C1; 892C1; 83C1, B1; 882C1; 80C1; 803C1; 825C1	Moderate Dr	Slight	Slight	Moderate E	Severe E	Moderate E, Dr	Slight
8							
490C1; 332C1; 335C1; 376B1, C1; 41C1; 377C1; 44C1; 40C1	Slight	Slight	Slight	Moderate E	Severe E	Slight	Slight

Table 5 Estimated Soil Limitations For Recreational Use, Cont'd.

Interpretive Group	Permanent Buildings (1)	Picnic and Play Areas (2)	Hiking Trails (3)	Campsites (4)	Parking Lots (5)	Boat Ramp and Beach Development (6)	Access Roads (7)
9							
133; 180; 181A, A2; 283; 237; 297; 10A, C; 16A, C; 116A	Severe Fl	Moderate Fl, St	Slight	Moderate Fl	Severe Fl	Slight	Severe Fl
10							
380B1; 379B1; 490B1; 339B1; 41B1; 377B1; 332B1; 44B1; 40B1	Moderate Fl	Slight	Slight	Slight	Slight	Slight	Slight
11							
380A1; 379A1; 377A1	Moderate Fl	Slight	Slight	Slight	Slight	Slight	Slight
12							
805B1, C1; 857C1; 836C1	Moderate Dr	Slight	Slight	Slight	Slight	Moderate Dr	Moderate Dr

Major kind of limitation:

Dr - Depth to rock, shallowness.
Fl - Flood hazard - on site evaluation necessary. Ridgetop soils with this rating pond water on the surface.
St - Stoniness, rockiness or gravelly surface.
Wt - Water table, seasonal high.
Sl - Slope
Fp - Fragipan
Perm - Permeability; S-too slow
C - Compaction
E - Erosion and or slump hazard

Table six (6) estimates the suitability of the soils for use in construction and lists some characteristics that affect their use. This information supplements table 5 by providing more detailed information. Each of the columns are described with the ratings defined in terms of how they affect different recreation uses.

2. Sewage Effluent Disposal is rated in terms of degrees of limitation of use as drainage fields for disposal of effluent from adequately designed septic systems.

   Slight means the soil can absorb, store and adequately filter the effluent without creating health hazards. Percolation rates are faster than one inch in 30 minutes.

   Moderate means that some soil limitations, such as depth or percolation restrictions, will cause percolation or storage difficulties if not overcome with remedial design. Percolation rates are between 30 and 60 minutes per inch.

   Severe means that the soil limitations, if not overcome, will severely restrict the function of the septic system and/or create a health hazard. Percolation rates are slower than 60 minutes per inch.

3. Compaction Potential rates the soils for their ability to withstand damage from foot traffic under intensive use. Proper maintenance of the turf is assumed.

   Low potential means the soil is not expected to compact and erode for several seasons. These soils have thick, loamy surface layers high in organic matter. The subsoils are readily permeable.

   Medium potential means a soil has a fair capacity to withstand compaction, but will probably break down in several seasons if not rotated.

   High potential means the soil will become compacted and begin to erode under normal use in one or two seasons. These areas should have restricted use, if any.

4. Frost Action Potential refers to the degree of expansion of the soil material upon freezing. Soil texture, water content of the soil and environmental conditions affect this factor.

   Low means that infrequent expansion with a low volume change can take place. However, under certain environment conditions, considerable frost action can occur.

   Medium means that expansion can occur occasionally with a moderate degree of volume change.

   High means that expansion can occur regularly with a moderate to high degree of volume change.

5. Flood Hazard refers in most instances to water overflow from a stream. Ponding occurs on some soils because of restricted internal drainage. Some soils are subject to both flooding and ponding.

Slight means the soil may flood during the early spring months in less than one year out of ten.

Moderate means the soil floods during the early spring months in more than one year in ten.

Severe means the soil floods during the season of use about once in ten years and floods in the early spring of most years. Ponding also occurs.

6. Topsoil refers to the dark surface layer of the natural soil.

Good means the surface layer is over 5 inches thick and is not gravelly.

Fair means the surface layer is from 3 to 5 inches thick and/or is gravelly.

Poor means the surface layer is less than three inches thick or would be difficult to extract.

7. Sand or Gravel is mentioned for applicable soils. This is a general rating because the area is so variable. An on the site investigation is necessary for determining quantity and quality.

N/A means sand or gravel doesn't occur in extractable conditions.

Poor means the soils contain sandy materials but are thin and/or are mixed with variable amounts of silt and clay.

Good means that sand and or gravel occurs in most soils of this group and is relatively thick.

Table 6 Selected Ratings That Affect Recreational Use of The Soils

Interpretive Group	General Description of Soils in the Group (1)	Sewage 1/ effluent disposal (2)	Compaction Potential (3)	Frost Action Potential (4)	Flood Hazard (5)	Suitability as a Source of	
						Topsoil (6)	Sand & Gravel (7)
1							
878G1; 438E1, F1; 444F1; 490E1, F1; 857D1, E1; 813F1; 707C1, E1; 41 E1, F1; 43F1; 793E1, F1; 892E1; 882E1; 723E1, F1, G1; 704C1; 725C1, C2, D2, E1, E3, F1; 80E1, E3; 864E1; 842E1, F1; 011; 492F1; 81E1, E3; 840F1; 867F1; 883E1, F1; 332E1	Moderately steep to very steep soils, some of which are rocky and or stony.	Severe Perm (S) St, Sl	High	Low	N/A 3/	Poor	N/A 3/
2							
191, 390, 112	Nearly level, poorly drained soils in bottoms and low terrace.	Severe Wt, Perm (S)	High	High	Severe	Poor	N/A
3							
490D1; 332D1; 438D1; 376D1; 41D1; 793C1; 725D1, D3; 40D1; 842D3	Strongly sloping, well drained, and deep soils on toe-slopes.	Severe Sl	Low to Med	Low	N/A	Poor	N/A
4							
805D1; 864D1; 892D1; 80D1; 803D1; 821D1, D3; 825D1; 83D1	Strongly sloping and moderately deep soils on ridges and benches.	Severe Dr, Sl	Low to Med	Low	N/A	Poor	N/A
5							
387A; 184; 185; 286; 480; 46B1; 47B1	Nearly level, somewhat poorly drained soils in bottoms and low terraces.	Severe Wt Perm (S)	High	High	Severe	Fair	Poor, sand (185)
6							
383B1, C1; 86B1, C1	Gently sloping and moderately well drained soils on terraces. Soils have fragipans.	Severe Fp, Perm (S)	Low to Med	Med	Some Ponding	Good	Poor, sand (383B1, 383C1)

Table 6 Selected Ratings That Affect Recreational Use of The Soils , Cont'd.

Interpretive Group	General Description of Soils in the Group (1)	Sewage 1/ effluent disposal (2)	Compaction Potential (3)	Frost Action Potential (4)	Flood Hazard (5)	Suitability as a Source of	
						Topsoil (6)	Sand & Gravel (7)
7							
864B1, C1; 892C1; 83C1, B1; 882C1; 80C1; 803C1; 825C1	Sloping, moderately deep soil on ridges.	Severe Dr Perm (S)	Med to High	Low	N/A 3/	Fair	N/A 3/
8							
490C1; 332C1; 335C1; 376B1, C1; 41C1; 377C1; 44C1; 40C1	Sloping, deep soils on toe-slopes and low terraces or fans.	Moderate Sl	Low	Low	Slight	Good	Poor, sand (376C1, 41C1, 376B1)
9							
133; 180; 181A, A2; 283; 237; 297; 10A, C; 16A, C; 116A	Nearly level, well drained soils on bottoms.	Severe Fl	Low	Med	Severe	Good	Fair, sand or gravel. (all except 180, 10A, 10C)
10							
380B1; 379B1; 490B1; 339B1; 41B1; 377B1; 332B1; 44B1; 40B1	Gently sloping well drained soils on terraces and fans.	Slight to Moderate Fl	Low	Low	Moderate	Good	Poor, sand (380B1, 41B1)
11							
380A1; 379A1; 377A1	Nearly level, well drained soils on terraces.	Slight to Moderate Fl	Low	Low	Moderate	Good	Fair, sand (380A1)
12							
805B1, C1; 857C1; 836C1	Moderately deep sandy soils on ridgetops.	Severe Dr	Low	Low	N/A	Fair	Fair, sand

1/ See abbreviations at the bottom of table five, this section.
2/ The rating applies to the soil mapping units listed in this colnum.
3/ Not applicable.

GENERAL DISCUSSION OF MAJOR LIMITING FACTORS

Nearly all the soils to be dealt with at intensivly used recreation sites have some limiting factors concerning soil use and management. All of the soil characteristics and qualities that determine these limiting factors do not need to be described here. However, some of the ways and means of changing or by-passing these characteristics and qualities so that the more common limiting factors can be overcome should be mentioned. Soil scientists can provide some of these recommendations and this kind of information can be given more specifically for each soil when the actual location of the facilities has been chosen.

The common limiting factors concerning recreation use of the soils are soil trafficability and soil compaction. These factors are briefly discussed for some kinds of soils in general terms. This discussion is intended to give the land manager ideas on the information that can be obtained from the soil maps and this report.

Soil trafficability and how it affects parking lots and access roads. Trafficability concerns the ability of a soil to support moving vehicles. Two general kinds of soils give most of the trafficability problems.

A. Soils with seasonally high water tables, that flood or pond frequently and/or are not well drained. In order for roads on these soils to perform well, the road bed must be kept free of standing water or a saturated condition. Some general management recommendations for these soils follow:

    1. Place the road on the crest or upper part of the slope, avoid depressions. Seeps are common in some of these soils,
    2. Build-up the road bed with coarse-grained or sandy materials so that it's higher than the natural landscape. Simply ditching on each side of the road bed without adequate build-up won't necessarily work.
    3. Provide a maxium amount of culverts and/or grassed waterways to remove excess water. Outlets for culverts, drainage tile or water ways are scarce in many places.

B. Soils high in clay that are very erosive. Some general management recommendations follow:

    1. Use coarse-grained materials for the road subgrades that would underlie the gravel or pavement.
    2. Provide good drainage to prevent moisture variation of the soil material and the subsequent shrinking and swelling.
    3. Moisture content of fill material derived from these soils should be closely controlled during compaction to facilitate a well compacted road bed.

Soil compaction as related to paths, picnic areas and camping areas. Compactability here refers to the ability of the soil to resist damage from foot traffic. Following are some general topics on soil compaction applicable to many soils in the area. Management recommendations are only general:

1. Plant compaction-tolerant plants that might make a more durable campsite floor. Path rush, a plant that grows well on compacted areas, might be tried.
2. Control the boundaries of user areas with thorny shrubs as barriers. Suit the species to the soil.
3. Restricting or preventing use of sites during the wet period would help. Up to certain levels of moisture content, the wetter the soil the more opportunity for compaction.
4. Providing enough camping and picnic sites to allow rotation and rest periods should be considered.
5. Sites that become seriously compacted and barren should be barred from use and definite rehabilitation steps taken. Both physical and vegetation methods of rehabilitation could be considered.
6. Development and maintenance of the vegetative cover should include necessary liming, fertilizing, and trimming to insure adequate growth for optimum protection of the soil.
7. The location of residual trees or planted ones will probably affect not only shade, but longevity of ground cover and soil loss. Picnic and camp sites with open canopies, which allow sunlight to reach the forest floor, seem to resist site deterioration of vegetation and soil as opposed to sites with dense shading.
8. Surface intensive use areas found at picnic and camp areas. Paths, unless intensively used, need only to be rotated occasionally on many soils. Some soils require surfacing for paths.

E. Wildlife Management 1/

Soils information can be very useful to the land manager interested in improving the wildlife habitat on the Districts. First of all he can determine the species or group of species best suited to each soil management area from the first part of this section table 7. The wildlife management direction discussed for each soil management area is based on the soil pattern, fertility of the soils, land use pattern, and forest types. Secondly, he can use the soils information in table 8 of this section to determine specific management practices, suitable to the different soils, that will improve the habitat for the particular species of wildlife. Table 8 has rated 12 different wildlife groupings of the soils for the major habitat elements commonly manipulated to improve wildlife habitats. The soils are grouped according to their similarity of behavior for those management practices rated. For added information a list of the common plants found in the area are included in table 9.

1/ Assistance in preparing this section was provided by Joe Hogan, Wildlife Specialist, Daniel Boone National Forest.

Table 7 - Wildlife Management by Soil Management Areas

(See Soil Management Area Map)

Area Description Numbers correspond to Those on the Soil Management Area Map	General Location[1] Cover Type[2]	Common Trees and Shrubs of Wooded Areas[2]	Probable Timber Management Direction	Wildlife Habitat				Common Key Soils to Improve Habitat[3]
				Deer	Grouse	Squirrel	Turkey	
1. Cranston-Berks Management Area. Steep to very steep smooth sideslopes and narrow bottoms and ridgetops.	Morehead District. Areas in oak or oak-hickory cover type. North slopes have some yellow poplar and upper slopes some yellow pine.[2]	White oak, chestnut oak, pignut and mockernut hickories. Dogwood, sourwood, blueberry, greenbrier, shadbush, sassafras and grape. Some old fields have reverted to yellow pine thickets.	Hardwoods. Some areas that are pine-hardwood may be kept that way. Berks soil should be left for watershed protection and wildlife management.	Fair; lacks water and cover	Fair; lacks cover.	Good; let hardwoods mature	Fair; lacks water and sod clearing.	Gilpin (864) Tilsit (86) on terraces in adjacent management Area No. 3.
2. Jefferson-Brookside-Dekalb Management Area. Steep stony and rocky soils with sandstone and limestone cliffs.	Mostly Stanton District. Area in oak-yellow poplar or cove hardwood type[2]	Below cliffs: Yellow poplar, white oak, shagbark hickory, scarlet oak, ash rhododendron, redbud, witch hazel, spice bush, paw paw, grape and hydrangea. Above cliffs: Yellow pine, pignut and mockernut hickories, chestnut oak, sourwood, azalea, blueberry, sassafras, dogwood, mountain laurel.	Below cliff: Hardwoods. Above cliff: Pine-hardwood.	Fair; lacks brush clearings.	Good; needs more clearings.	Good	Fair; needs mature hardwood stands.	Talbott (707) - limestone Brookside (444)-limestone Whitley (83)
3. Tilsit-Elk-Clifty Management Area. Nearly level to gently sloping terraces and bottoms.	Morehead District. These areas should be managed for habitat elements that complement wildlife management in adjacent Soil Management Areas. Area mostly cleared and farmed.	Mostly cleared or old fields that have reverted to yellow pine stands. Some areas wooded with bottomland hardwoods, i.e., yellow poplar, sycamore, sweetgum, and oaks and hickories. Shrubs are dogwood, spice bush, musclewood, briers, paw paw and sassafras.	Best opportunity to maintain clearings to complement adjacent Management Areas by gaining edge effect. Pine-hardwoods or hardwoods if managed for timber.	Poor; lacks cover.	Fair to Good	Poor; lacks mast	Poor; lacks cover.	Tilsit (86) Elk (379 or 377)
4. Wharton-Shelocta Manage- Area. A well dissected landscape with narrow ridges and short smooth sideslopes above the large cliff.	Eastern edge of both Districts. Most areas cleared. Wooded areas in oak-hickory or pine-oak cover type[2]	Many areas are old fields with shortleaf and Virginia pine stands. Some areas are mostly hardwood with major species of white oak and hickories. Common associated trees in these hardwood stands are yellow pine and yellow poplar. Dominant shrubs include dogwood, sourwood, greenbrier and red maple.	Hardwood or hardwood-pine. Pure pine stands will decrease in number as the hardwoods gradually take over.	Fair; lacks water.	Good	Fair; lacks mature hardwoods in many areas.	Poor; lacks mature hardwood stands.	Whitley (83) Tilsit (86)
5. Berks-Cranston-Wharton Management Area. Steep to very steep sideslopes with areas of moderately wide ridgetops. Some lower very steep slopes are rocky.	Morehead District. Oak or oak-hickory cover types.[2]	Chestnut oak, scarlet oak, white oak, hickories and some yellow pine. Some ridgetops are old fields with pure yellow pine stands or pine-hardwood stands. Shrubs similar to Area 1.	Hardwoods. Some ridges may be kept in pine or pine-hardwood.	Good to Fair; needs more evergreen cover.	Good to Fair; needs more evergreen cover.	Good	Fair; lacks park-like stands of hardwoods.	Wharton (882 or 892)
6. Jefferson-Cranston-Dekalb Management Area. Giant sandstone cliff with steep, stony soils below. Some benches of Caneyville and Brookside soils.	Cliff Country. Southeastern Rowan County, Yokum Creek Area and Red River Gorge Area. Oak-yellow poplar or cove hardwood cover type. Above cliffs it is pine-oak or oak-hickory[2]	Below Cliff: Yellow poplar, white oak, hemlock, black oak, hickories, rhododendron, paw paw, black gum, and dogwood. Above cliff: Yellow pine, hickories, chestnut oak, sourwood, azalea, blueberry, sassafras, dogwood and mountain laurel.	Below cliff: Hardwoods or cove hardwoods. Above cliff: Pine-hardwood.	Fair; needs brush clearings.	Fair to Good	Good	Fair; needs clearings.	Wharton (882 or 892) Talbott (707) - limestone Brookside (444)-limestone
7. Tilsit-Wharton-Johnsburg Management Area. Nearly level to sloping broad ridgetops.	Caney Creek Area, Scott Creek Area and Zilpo Area on Morehead District. Most areas farmed or old fields.	Recreation areas have dominance in this management area. These are old fields and some pure pine stands and pine-oak cover types. If possible, these areas should be used to help improve the wildlife habitat in adjacent management areas. Rabbit and quail are common in this management area.	Hardwoods (leave areas)	Fair; lacks adequate cover.	Fair; lacks well spaced cover.	Poor; lacks mature hardwoods.	Poor; lacks mature hardwood stands.	Tilsit (86) Wharton (882 or 892)
8. Talbott-Wharton Management Area. Broad ridgetops, knobs and short upper slopes.	Pretty Ridge Area and Tater Knob Area on Morehead District. Oaks or oak-hickory cover type dominates.[2]	White oak, scarlet oak, black oak, white ash, shortleaf pine, hickories including shellbark, dogwood, grape, redbud, sugar maple, ironwood, red cedar and sassafras.	Hardwoods	Fair; needs clearings, cover, water.	Fair; needs clearings and cover	Good	Fair; lacks sod clearings.	Talbott (707) - limestone Wharton (882 or 892)
9. Shelocta-Jefferson-Wharton Management Area. Broad ridges, cliffs and steep, stony sideslopes.	Willow Branch Area, and Sinking Creek on Stanton District. Oak-hickory or oak cover type.[2]	White oak, scarlet oak, hickories, black oak. Yellow poplar and other cove hardwoods in deep drains under cliffs. Shrubs are dogwood, red maple, sourwood and green brier.	Hardwoods	Fair; needs clearings.	Good	Good	Fair; needs mature hardwood stands.	Whitley (83)

1/ Refer to the Soil Managment Area map.
2/ Refer to vegetation section in Part I.
3/ Refer to Table 8 - Ratings of Habitat Elements after locating specific areas on the soil map.

SUITABILITY RATINGS OF SOILS FOR HABITAT ELEMENTS

Six habitat elements are rated for the soils on the Districts in table 8. The group numbers refer to the soil mapping units on the aerial photographs. Under the current level of land management on the Forest, wildlife management is integrated with the other phases of land use and the kind and amount of wildlife is dependent primarily upon existing land use patterns and vegetation. The wildlife management projects (clearings, ponds, etc.) for which the soils are rated, are considered complementary practice to present habitat conditions. After evaluating the existing conditions and determing habitat needs, the biologist or land manager can refer to the suitability ratings of the different soils to obtain the needed habitat elements by geographic area or soil management area. Definitions of ratings given in columns 2, 5 and 6 of table 8. Well suited: Habitats generally are easily created, improved, or maintained on soils rated as well suited. There are few or no soil limitations to habitat management, and satisfactory results as well assured. Suited: Habitats usually can be created, improved, or maintained on soils rated as suited, but there are moderate soil limitations that affect management of habitats. Moderate intensity of management fairly frequent attention may be required to assure satisfactory results. Not suited: Habitats cannot be created, improved, or maintained on soils rated as not suited, or it is impractical to do so under prevailing soil conditions. Unsatisfactory results are probable. Definitions of habitat elements in table 8.

(1) Average Site Index: An average of the different soils in each group is given to give the reader an idea of the site quality.

(2) Fenuron: This is a herbicide to be applied in pellet form to kill hardwood trees, particularly on low quality hardwood sites. Killing overstory hardwoods will allow plants of the herb layer to grow and provide wildlife food.

(3) Grasses and legumes: Domestic perennial grasses and herbaceous legumes that are established by planting and that furnish wildlife food and cover. If a particular soil is rated suited or well suited for grasses and legumes, detailed information on adapted species, fertilizer, liming and seeding rates, etc. can be obtained in the Agronomic Section of this report. Simply refer to the appropriate Agronomic group in the key for the mapping units involved.

(4) Wild Herbaceous Plants: These are the native perennial grasses, forbs and weeds that comprise the ground layer in the forest or in clearings on the different soils. The abundance and vigor of most herbaceous plants increases when overhead trees and shrubs are cleared. Some herbaceous plant species occur only on certain soils but many species occur over a broad range of different soils. However, particular groups or communities of herbaceous plants and the abundance and vigor of the individual plants does vary by soil. Four different communities of herbaceous plants on the ground layer can generally be identified on the Districts. The plants common to each community are given below and table 8 gives the community or communities that can be expected on each of the 12 interpretive soil groups.

Ground Layer Community	Site	Some Common Herbaceous Plants
1.	mesic (Site index 85+)	Hydrangea, giant ragweed, beggars lice, wild sweet potato, merry bells, rattlesnake root, fox glove, Christmas fern, coral bells, solomon seal, greenbrier, bedstraw, wild geranium .
2.	mesic-xeric (Site index 65-85)	Coreopsis, false solomon seal, panic grasses, hawkweed, dwarf dandelion, greenbrier, lespedeza, bluestem, cinquefoil, barren strawberry.
3.	Xeric (Site index 65)	Trailing arbutus, wintergreen, pussy toes, greenbrier, vetch, coreopsis, false solomon seal.
4.	Wetland	Sedges, cat tails, smartweed, ironweed, joe-pye-weed, foxtail, milkweed.

(5) Hardwood woody plants: These are hardwood shrubs, woody vines and small trees that have some value as wildlife food and cover. Different soils tend to support different shrub communities although there is a great deal of species overlap. The generalized shrub communities existing and that can be expected in clearings on the soils of the wildlife interpretive groups are shown in table 8 using the following key:

Shrub Community	Site	Some Shrubs, vines, and small tree
A.	Mesic (Site index 85+) Cove hardwoods	Wild grape, black berry, Hercules club, holly, elderberry, hazelnut, paw paw, red bud, spicebush, ironwood, strawberry bush, honeysuckle, pepperbush.

B	Mesic-xeric (Site index 65 to 85) Hardwoods or Hardwood-pine	Dogwood, sassafras, witch hazel, shadbush, highbush blueberry, wild grape, summac, New Jersey tea, sourwood, maple leaf viburnum, blackberry, honeysuckle, greenbrier.
C	Xeric (Site index 65) pine or pine-hardwood	Highbush blueberry, azalea, dogwood, red maple, sassafras, shadbush, sour-wood, greenbrier, grape.
D	Wetland Bottomland species	Alder, sweet gum, river birch, blackberry, willow, honeysuckle, buttonbush.

Two shrub communities are shown for some interpretive groups. In these instances the cool aspects would tend to support the more mesic group listed and hot aspects the more xeric group.

(6) Coniferous or evergreen woody shrubs and trees: These are conebearing trees and evergreen shrubs, important to wildlife mainly as cover, but also may furnish food in the form of browse, seeds or fruit-like cones. Table 8 shows the groups of conifers and evergreens commonly growing and easily managed on the different soils interpretive groups.

I.	Mesic	Hemlock, white pine, rhododendron, red cedar 1/ holly.
II.	mesic-xeric (Site index 65 to 85)	Yellow pine, white pine, mountain laurel, red cedar 1/
III.	Xeric	Yellow pine, mountain laurel.

(7) Excavated ponds: Dug-out water areas or combinations of dug-out areas and low dikes (dammed areas) that have water of suitable quality, of suitable depth, and in ample supply for production of fish or wildlife. The factors considered are the physical characteristics of the soil profile such as texture and depth to rock and landscape features such as slope and stoniness.

1/ Associated primarily with soils developed from limestone.

Table 8 Ratings of Habitat Elements For Wildlife Management

Group With Included Soil Mapping Units	Average Site 1/ Index (1)	Fenuron lbs/ac. (2)	Grasses and 3/ Legumes (3)	Wild Herb-aceous Plants (4)	Hard wood Woody Plants (5)	Conif-erous Wood Plants (6)	Exca-vated Ponds 4/ (7)
1							
878G1	Oak 55	40	Not Suited	3	C	III	Not Suited
2							
191; 390	Sweet Gum 95+	NR 2/	Suited	4	D	Not Suited	Suited
3							
380A1, B1; 379A1, B1; 339B1; 490B1; 377B1; 41B1; 335B1; 44B1; 40B1; 332B1	Oak 85+	20	Well Suited	1	A	I	Not Suited
4							
805D1; 857C1, D1, E1; 836C1, D1; 82D1; 011	Oak 60	40	Suited	3	C	III	Not Suited
5							
805B1, C1; 864B1; C1; 80C1	Oak 65	20	Suited	2	C,B	II	Not Suited
6							
387A; 480; 112; 185; 286; 184; 46B1; 47B1	Sweet Gum 95+	NR 2/	Suited	4	D	Not Suited	Suited
7							
332C1, D1; 490C1, D1; 376B1, C1, D1; 41C1, D1; 377C1, D1; 335C1, D1; 40C1, D1; 44C1; 438D1; 793C1; 383B1, C1; 86B1, C1	Oak 75	20	Not Suited	2	B	II	Well Suited

Table 8 Ratings of Habitat Elements For Wildlife Management , Cont'd.

Group With Included Soil Mapping Units	Average Site 1/ Index (1)	Fenuron lbs/ac. (2)	Grasses and 3/ Legumes (3)	Wild Herb-aceous Plants (4)	Hard-wood Woody Plants (5)	Conif-erous Wood Plants (6)	Exca-vated Ponds 4/ (7)
8							
332E1; 813F1; 438E1, F1; 490E1, F1; 892E1; 882E1; 80E1, E3; 864E1; 842E1, F1; 81E1, E3; 840F1, F3, G1; 867F1; 883E1, F1	Oak S-65 N-75	20	Not Suited	2	B,C	II	Suited
9							
41E1, F1; 43F1; 793E1, F1; 444F1; 723E1, F1, G1; 725E1, F1; 492F1	Oak 80	20	Not Suited	1	A,B	I	Not Suited
10							
133; 181A, A2; 180; 297; 237; 283; 10A, C; 16A, C; 116A	Oak 85	40	Well Suited	1,2	A	I	Not Suited
11							
707C1, E1; 704C1; 725C1, C2, D1, D2, D3, E1, E3	Oak 65	20	Suited	2,1	B,A	II	Not Suited
12							
892C1, D1, D3; 882C1, D1; 825C1, D1; 821C1, D1, D3, 803C1, D1; 83C1, D1; 864D1; 80D1	Oak 65	20	Suited	2,3	B,C	II	Suited

1/ For details on site index refer to the Timber Management Section.
2/ Soils are wet and they pond water or flood.
3/ Refer to the Agronomic Section.
4/ For more accurate information refer to the Engineering Section.

SOME COMMON PLANTS OF THE AREA

Table 9 lists some of the major trees, shrubs, vines and herb layer plants, that occur on the Districts. The first two columns give the common and scientific names of the species. Source of the names is Grays Manual of Botany, Eighth Edition. The following narrative explains other columns:

Importance to wildlife: Plants considered important as food or cover to the four primary woodland wildlife species are noted by listing the wildlife species primarily benefitting. D-Deer, G-Grouse, S-Squirrel, T-Turkey.

Importance to Recreation:

A. Trees. The trees are ranked as to their ability to withstand the impact of recreational use 1/. For instance; at a given recreational site hickories are able to remain a healthy tree (resisting diseases and insects and withstanding soil compaction) than yellow-poplar and yellow-poplar to a greater extent than white oak and so on. Hardwoods are ranked numerically and conifers alphabetically.

Hardwoods				Conifers	
1.	Hickories	10.	Blackgum	A.	Shortleaf Pine
2.	Persimmon	11.	Red Maple	B.	Hemlocks
3.	Sycamore	12.	Sourwood	C.	White Pine
4.	White Ash	13.	White Oaks	D.	Pitch Pine
5.	Beech	14.	Black Walnut	E.	Virginia Pine
6.	Sassafras	15.	Red Oaks		
7.	Buckeye	16.	Black Locust		
8.	Yellow-poplar	17.	Magnolia		
9.	Dogwood	18.	Black Cherry		

B and C. Shrubs and Vines. Remarks helpful to the use of some of these native species are made in this column.

D. Herbs. No recreational rating given. However many of these species have beautiful flowers of interest to nature lovers.

Soil Groups Where Common: The soil group(s) where each plant is commonly found are listed. The plants can occur on other soil groups but are not as vigorous or abundant as on the soil groups listed.

1/ Ripley, Thomas H. - Station Paper No. 153, "Recreation Impact on Southern Appalachian Campgrounds and Picnic Sites," November 1962; and Ripley, Thomas H. - Research Notes No. 171, "Trees and Shrub Response to Recreation Use," February 1962, Southeastern Forest Experiment Station, Asheville, North Carolina.

The following key (1 thru 11) shows the soil mapping units included with each group. These soil groups are similar to timber management groupings.

#1

191; 184; 185; 112; 46B1

47B1; 480; 390; 387A

#2

133; 180; 181A, A2; 297

237; 380A1, B1; 379A1, B1;

377A1, B1; 377B1, C1; 339B1

335B1, C1, D1; 376B1, C1, D1;

793C1; 44B1; 332B1, C1; 40B1,

C1, D1

#3

86B1, C1; 383B1, C1

#4

864B1, C1, D1; 83C1, D1; 805B1,

C1, D1; 80C1, D1; 836C1

#5

892C1, D1; 803C1, D1;

821D1, D3; 332D1; 825C1,

D1; 882C1, D1; 438D1

#6

892E1; 882E1; 438E1, F1; 813F1;

332E1; 80E1, E3; 864E1; 81E1, E3;

840F1, F3, G1

#7

707C1, E1; 704C1; 725C1, C2,

02

#8

444F1; 723E1, F1, G1

#9

41E1, F1; 43F1; 793E1, F1; 725E1,

E3, F1; 492F1

#10

490E1, F1; 842E1, F1

#11

857C1, D1, E1; 878G1; 011

TABLE 9 Some trees, shrubs, vines, and plants found in the herb layer on the District. Their importance to wildlife and recreation and kind of soil where commonly found.

A. TREES

Common Name	Scientific Name	Importance To Wildlife	Importance To Recreation	Soil Groups Where Common
Ash, White	Fraxinus Americana	T	4	7 thru 9
Basswood, White	Tilia heterophylla			8 thru 9
American	Tilia Americana			8 thru 9
Beech, American	Fagus grandifolia	S, T	5	2, 3, 8, 9, 10
Birch, River	Betula nigra			1, 2
Sweet or Black	Betula lenta			2, 9
Blackgum	Nyssa sylvatica	D, G, S, T	10	1 thru 11
Boxelder	Acer negundo			1, 2
Buckeye, Ohio	Aesculus glabra	D, S	7	2, 8
Yellow	Aesculus octandra	D, S	7	2, 8
Butternut	Juglans cinerea	D, S		7, 8
Cherry, Black	Prunus serotina	D, G, S	18	2, 7, 8
Cucumber Tree	Magnolia acuminata	D	17	2, 8, 9
Dogwood, Flowering	Cornus Florida	D, G, S, T	9	1 thru 11
Elm, American	Ulmus Americana	D, S		7, 8, 9
Slippery	Ulmus rubra	D, S		7, 8, 9
Hemlock, Eastern	Tsuga canadensis	D, G, S	B	6, 9
Hickory, Bitternut	Carya cordiformis	S	1	1, 7, 8, 9
Mockernut	Carya tomentosa	S	1	3 thru 11
Pignut	Carya glabra	S	1	3 thru 11
Shellbark	Carya laciniosa	S	1	7, 8
Locust, Black	Robinia pseudoacacia	D	16	3, 6, 8, 9
Magnolia, Big leaf	Magnolia macrophylla	D	17	1, 8, 9
Maple, Red	Acer rubrum	D, G, S, T	11	1 thru 11
Silver	Acer saccharinum	D, G, S, T		1, 2
Sugar	Acer saccharum	D, G, S, T		2, 7, 8, 9

Trees continued:

Common Name	Scientific Name	Importance To Wildlife	Importance To Recreation	Soil Groups Where Common
Oak, Blackjack	Quercus marilandica	D, S, T		11
Black	Quercus velutina	D, S, T		4, 6, 7, 8, 9, 10
Chestnut	Quercus prinus	D, S, T	13	7, 10, 11
Northern Red	Quercus rubra	D, S, T	15	7, 8, 9
Pin	Quercus palustris	D, S, T		1
Post	Quercus stellata	D, S, T	13	11
Scarlet	Quercus coccinea	D, S, T		2, 3, 4, 5, 6, 9, 10, 11
Southern Red	Quercus falcata	D, S, T	15	8, 9, 11
White	Quercus alba	D, S, T	13	1 thru 11
Pawpaw	Asimina triloba	D		2, 8, 9
Persimmon, Common	Diospyros virginiana	D, G, S, T	2	Old fields
Pine, Eastern White	Pinus strobus	D, S	C	5, 6, 8, 9
Pitch	Pinus rigida	D, S	D	11
Shortleaf	Pinus echinata	D, S	A	1 thru 11
Virginia	Pinus virginiana	D, S	E	1 thru 11
Poplar, Tulip	Liriodendron tulipifera	D, G, S, T	8	1, 2, 3, 6, 8, 9, 10
Red Cedar, Eastern	Juniperus virginiana	D		7
Sassafras	Sassafras albidum	D, S, T	6	4, 5, 6, 9, 10, 11
Sourwood	Oxydendrum arboreum	D	12	3, 4, 5, 6, 9, 10, 11
Sweetgum	Liquidambar styrociflua			1, 3
Sycamore, American	Platanus occidentalis	D	3	1, 2
Walnut, Black	Juglans nigra	D, S	14	7, 8
Willow, Black	Salix nigra	D		1

B. SHRUBS

Azalea	Azolea nudiflora		Showy	5, 10, 11
Burning Bush	Euonymus atropurpureus	D	Showy	2, 9, 11
Beaked Hazelnut	Corylaceae family	D, S		8, 9
Buttonbush	Cephalanthus occidentalis	D		1
Buffalo-nut	Pyrularea pubera	D		2, 8, 9
Cane	Arundinaria spp.	D		1, 2

Shrubs continued:

Common Name	Scientific Name	Importance To Wildlife	Importance To Recreation	Soil Groups Where Common
Deerberry	Vaccinum Stamineum	D, G, T		4, 5, 10, 11
Devil's-Walking-Stick	Aralia spinosa	D, G		8, 9
Elderberry	Sambucus pubens	D		clearings
Flowering Dogwood	Cornus florida	D, G, S, T	Showy	1 thru 11
Hawthorn	Crataegus spp.	D, G, T,	Barrier	2, 7, 8
Highbush Blueberry	Vaccinium corymbosum	D, G, T		4, 5, 7, 10, 11
Holly	Ilex opoca	D, G, S, T	Barrier	2, 5, 9
Hophornbeam	Ostrya virginana	D		2, 7, 8, 9
Hornbeam	Carpinus caroliniana	D		1, 2, 8, 9, 10
Ironwood	Ostrya virginana	D		2, 7, 8, 9
Mapleleaf Viburnum	Viburnum acerifolium	D, G, S		3, 4, 5, 6, 8, 9, 10, 11
Mountain Camellia	Stewartia ovata	D		4, 6, 9
Mountain Laurel	Kalmia latifolia	D, G	evergreen	6, 9, 10, 11
Musclewood	Carpinus caroliniana	D		1, 2, 8, 9, 10
New Jersey tea	Ceanothus americanus	D		8, 9
Pawpaw	Asimina triloba	D		2, 8, 9
Persimmon	Diospyros virginiana	D, G		old fields
Redbud	Cercis canadensis	D, G		7, 8, 9
Rhododendron	Rhododendron maximum	D	evergreen	9, 11
Serviceberry or Shadbush	Amelanchier arborea	D, G, T	Showy	9, 10, 11
Spice Bush	Lindera benzoin	D, G, T,		2, 8, 9
Strawberry Bush	Euonymus atropurpureas	D	Showy	2, 9, 11
Sweet pepperbush	Clethra alnifolia	D		1, 2, 8, 9
Wing-rib Sumac	Rhus copallina	S, D, T		clearings
Virginia-Willow	Itea virginica	D		2, 6, 8, 9
Yaupon	Ilex vomitoria	D		7, 8
Witch hazel, common	Hamamelis virginiana	S		2, 6, 8, 9, 10

C. VINES

Common Name	Scientific Name	Importance To Wildlife	Recreation	Soil Groups Where Common
Bitter Sweet	Solanum dulcanara	D	Showy	7, 8
Cross Vine	Bigmonia capreulate	D		8
Grape	Vitis aestivalis	D, G, S, T		1 thru 11
Greenbrier and Sawbrier	Smilax spp.	D, G, S, T	Barrier	1 thru 11
Honeysuckle Japanese	Lonicera japonica	D, T	Showy	clearings
Poison Ivy	Rhus radicans	T		1, 2, 3, 6, 7, 8, 9, 10, 11
Trumpet-vine	Campsis rodicans	D	Showy	clearings
Virginia Creeper	Parthenocissus quinquefolia	D, G		1, 2, 3, 6, 7, 8, 9, 10, 11

D. PLANTS OF THE HERB LAYER

Aster	Aster spp.			11
Barren Strawberry	Waldsteinia fragrioides			5, 6, 9, 10, 11
Bed Straw	Galium spp.			1, 2, 8, 9, 10
Beech Fern	Dryopteris			6, 8, 9
Beggars Lice	Desmodium spp.	D, G, T		2, 4, 5, 6, 7, 8, 9, 10, 11
Bellwort	Uvularia spp.			8, 9
Blackberry	Rubus occidentalis	D, G, T		clearings
Black-eyed Susan	Rudbeckia hirta			clearings
Blood Root	Sanguinaria canadensis			8
Blueberry	Vaccinium vacillans	D, G, S, T		4, 5, 10, 11
Blue Phlox	Phloxdivaricata			10, 11
Blue Stem	Andropogon scoparius	D		clearings
Bluet	Houstonia			9, 10, 11
Braken Fern	Pteridium Aquilinum Var. pseudocaudstum			5, 10, 11
Broad Beech Fern	Dryopteris hexagonoptera			2, 8, 9
Broom Sedge	Andropogon virginicus			clearings
Buckhorn plantaim	Plantago lanceolata	D		clearings
Bush Clover	Lespedeza spp.	D, G, T		clearings
Butterfly-Pea	Clitoria mariana	D		11
Butterfly-Weed	Ascleplas tuberosa	D		clearings
Cacalia	Cacalia spp.			2, 8, 9

Plants of the herb layer continued:

Common Name	Scientific Name	Importance To Wildlife	Recreation	Soil Groups Where Common
Carrot	Umbelliferae Family			10, 11
Cat Brier	Smilax glauca	D, G, S, T		3 thru 11
Cat Tail	Typha spp.			1
Christmas Fern	Polystichum acrostichoides			1, 2, 3, 6, 8, 9, 10
Cinquefoil	Rosaceae potentilla			2, 5, 6, 9, 10
Cocklebur	Rosaceae agrimonia Var. rostilata	D, S		1, 2
Coral Bells	Heuchera spp.			2, 8, 9, 10
Coreopsis	Coreopsis spp.			4, 5, 6, 9, 10, 11
Cress	Sisymbrium spp.			1
Crow Foot	Rhununculus hispidis			4, 5, 6
Cucumber Root	Medeola virginiana			8, 9
Daisy Common	Chrysanthemum leucanthemum			2
Daisy fleabane	Erigeron annuus			2
Dog Tooth Violet	Erythronium americana			2, 8, 10
Dwarf Dandelion	Krigia	G		5, 9
Dwarf Iris	Iris			2, 8, 9, 10
Enchanters Nightshade	Circaea quadrisuleata			8, 9
English Plantain	Plantago lanceolata			clearings
Fairy Wand	Chamaelirium luteum			2, 9
False Foxglove	Gerardia spp.			8, 10
False Solomon's Seal	Smilacina racemosae	D		5, 6, 8, 9, 10, 11
Fire Pink	Silene virginica			7, 8, 9
Foam Flower	Tiarilla cardifolia			8, 9
Foxtail	Setaria spp.			1
Gensing	Gensing			8, 9
Goats Beard	Aruncus spp.			7, 8, 9
Goats Rue	Tephrosia virginiana			3, 4, 5, 6, 11
Great Rayweed	Ambrosia trifida	G, T		1, 2, 4, 5, 9
Ground Cherry	Physalis pubescens	D		8, 9
Hawkweed	Hieracium verosum	D		5
Heal-All	Prunella vulgaris			2, 6, 9

Plants of the herb layer continued:

Common Name	Scientific Name	Importance To Wildlife	Recreation	Soil Groups Where Common
Hepatica	Hepatica spp.			8, 9
Huckleberry	Gaylussacia spp.	D, G, S, T		4, 11
Hydrangea	Hydrangea arborescens	D, T		2, 8, 9
Indiana Pink	Spigelia marilandica			8, 9
Ironweed	Vernonia noveboracensis			1, 2
Jack-in-the-Pulpit	Arisaema spp.			8, 9
Joe-Pye-Weed	Eupatorium spp.			1, 2
Lady Slipper	Cypripidium acanle			4, 5, 6, 8
Lespedeza	Leapedeza spp.	D, G, S, T		4, 5, 7, 8
Loose Strife	Lysimanchia spp.			clearings
Lopseed	Phryma leptostachya			8, 9
Maidenhair Fern	Adiantum pedatum			8, 9
Mandarin	Disporum spp.			2, 8, 9
May Apple	Podophyllum pelatum			8, 9
Merrybells	Uvularia perfoliata			7, 8, 9
Milfoil	Achillae millefolium			2, 8
Milkweed	Asclepeas quadrifolia			clearings
Milkwort	Polygala polygama			clearings
Mullein	Verbascum thapsus			clearings
Mustard, Field	Brassica campestris			clearings
Narrow Leaf Chair Fern	Woodwartia areolata			1, 2, 9
Nettle	Urticaeae Family			2, 9
Panic Grass	Pacicum spp.	D, G, S, T		1 thru 11
Partridge pea	Cassio fasciculath	G, T		6, 8, 9, 10
Pipsissewa	Chimaphila maculata	D		4, 6, 9
Poison Ivy	Rhus radicans	T		1 thru 11
Profanity Vine	Smilax tamnoides Var. hispida	D, G, T		6 thru 9
Pussy-Toes	Gnaphalium spp.			4, 5, 10, 11

Plants of the herb layer continued:

Common Name	Scientific Name	Importance To Wildlife	Importance To Recreation	Soil Groups Where Common
Queen Anne's Lace	Daucus carota			clearings
Rattlesnake Fern	Botrychium virginianum			6, 8, 9
Rattlesnake Plantain	Goodyera pubescens	D		6, 8, 9
Rattlesnake Root	Cimicifuga racemosa	D		2, 6, 8, 9
Red Clover	Trifolium pratense	D		clearings
Royal Fern	Osmunda regalis			1, 6, 9
Rue-anemone	Anemonella thalictroides	D		6, 8, 9
Sanicle (Black Snake Root)	Sanicula spp.			8, 9
Sawbrier	Smilax spp.	D, G, S, T		1 thru 11
Sedge	Corex spp.			1, 2, 8
Sickle Pod	Arabis laevigata			7, 8, 9
Skull Cap	Scutellaria spp.			2, 8, 9
Solomon's Seal	Polygonatum biflorum			2, 3, 8, 9, 10
Speckled Wood Lily	Clintonia umbellulata			2, 8, 9
Spotted Cranesbill (Wild Geranium)	Geranium maculatum	D, T		2, 8, 9
Spring Beauty	Claytonia virginica			6, 8, 9, 10
Squaw Weed	Senicio spp.			4, 5, 6
Stagbush	Viburnum prunifolium			8, 9
Star Chickweed	Stellaria pubera			2 thru 11
Stinging Nettle	Urtica chamaedryoides			2, 6, 8, 9
Stinking Benjamin	Trillium erectum			2, 8, 9
Tickseed	Coreopsis spp.			clearings
Tobacco Weed	Elephantopus tomentosus			7, 8, 9
Tooth Wart	Denta lociniata	D		2, 8, 9
Trailing Arbutus	Epigaea repens			4, 5, 11
Tramps Spurge	Euphorbia corollata	D		5, 10, 11
Venus Looking Glass	Specularia perfolia			4, 5, 6
Verbena	Verbena spp.			4, 5, 6, 9, 10

Plants of the herb layer continued:

Common Name	Scientific Name	Importance To Wildlife	Recreation	Soil Groups Where Common
Vetch	Vicia caroliniana	D		9, 10, 11
Violet	Viola spp.			2, 8, 9
Virginia Bluebells	Mertensia virginica			2
Virginia Creeper	Parthenocissus quinquefolia	D		1 thru 11
Virginia Snakeroot	Aristolochia serpentaria	D		8, 9
White Sweet Clover	Melilotus alba	D, G, T		1, 2, 8, 9
Whorled Loose Strife	Lysimachia quadrifolia	D		3, 4, 5, 6, 10
Wild Ginger	Asarum arifolium			8, 9
Wild Lettuce	Lacktuca spp.			clearings
Wild Rose	Rosa setigera			7, 8, 9
Wild Sweet Potato	Dioscorea quaternata			2, 7, 8, 9, 10
Wild Teasel	Dipsachus sylvestris	D, S, T		clearings
Wing-rib Sumac	Rhus copallina			clearings
Wintergreen	Gaultheria procumbens			4, 5, 6, 9, 10, 11
Yellow-eyed Grass	Hypoxis	D		clearings
Yellow Passion Flower	Passiflora lutea	D		8, 9
Yellow Sweet Clover	Melilotus officinalis	D		clearings

F. Suitability of Soils for Engineering Uses 1/

This part of the report gives information useful to engineers and land planners who plan to use the soil for structural material or as foundation material upon which structures are built. Listed and rated are those soil properties that affect the construction and maintenance of roads, pipelines, building foundations, water storage facilities, sewage disposal systems, etc. The important soil characteristics, qualities and features are rated or highlighted for the different uses in tables 10, 11, and 12. Chart 4 interprets the unified system of classifying soils for engineering purposes. The engineering interpretations reported here do not eliminate on the site investigation and special samples for a particular use involving heavy loads or deep excavations. Even in these situations though, the engineer can use the soil map and these interpretations to select those areas requiring further sampling and field investigations.

Soil information important to construction and related activities on National Forest land not covered in the Engineering section, may be found in other sections of this report. For instance slump and slide hazards are rated in the Water Management Section and seeding, liming and fertilizer recommendations are presented in the Agronomic Section.

1/ Assistance in preparing this section was provided by Bill Webb, Civil Engineer, Daniel Boone National Forest.

Table 10 - Estimated Physical and Chemical Properties of the Soils

Table 10 gives estimates of soil properties important to engineering. The estimates are based on field classification and descriptions, physical and chemical test of selected representative samples, test data from comparable soils in adjacent areas and from detailed experiences in working with the different soils in the area. The following narrative briefly explains the headings in each column.

(1) Drainage refers to the natural condition of the soil and is related to water table depth and length of time that the soil is saturated. Topography and landform configuration, to a large extent, determine the natural drainage class in the area.

(2) Depth to bedrock is estimated and means the depth of the regolith or unconsolidated material. Bedrock is either shale, siltstone, sandstone or limestone. Some shales are very easy to rip even though consolidated and coherent. Other rocks generally need blasting.

(3) Depth to seasonally high water table is the estimated depth to the water table after a prolonged period of rainfall. In some soils the water is perched by impervious bedrock or fragipans.

(4) Depth from the surface refers to the depth of the different important layers of soil in representative profiles for each soil series. The thickness of each layer is indicated by inches from the surface.

(5) USDA texture is determined by the relative proportions of sand, silt, and clay in soil samples representative of certain layers of the soil profile. Layers with over 15% gravel content have their USDA textural name modified with the adjective "gravelly". The USDA texture is concerned only with soil particles that are 2 millimeters in diameter or less.

(6) The AASHO system is used to classify soils according to those properties that affect use in highway construction. In this system a soil is placed in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid, and plasticity index. In group A-1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation) and, at the other extreme, clay soils that have low strength when wet. The best soils for subgrade are therefore classified as A-1, the next best A-2, and so on to class A-7, the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A-1, A-2, and A-7 groups are divided as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7; and A-7-5, A-7-6. If soil material is near a classification boundary it is given a symbol showing both classes; for example, A-2 or A-4. Within each group, the relative engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 for the poorest. The AASHO classification for tested soils, with index numbers in parenthesis, is shown in table; the estimated classification for all soils mapped in the survey area is given in table 10.

(7) In the Unified system soils are classified according to particle size distribution, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes. There are 8 classes of coarse-grained soils, indentified as GW, GP, GM, GC, SW, SP, SM, and SC; 6 classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH: and 1 class of highly organic soils, indentified at Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example Ch or MH. Refer to Chart 4 in this section for interpretations of the unified system pertinent to road foundations.

(8) CBR - California bearing ratio values evaluate the soil material for its use as subgrade material supporting pavements. Low values such as 3 to 5, mean the bearing capacity increases with increasingly higher values shown. Information on CBR values and method are in "PCA Soil Primer" published by Portland Cement Association and in "Soil Manual" by Division of Materials, Kentucky Department of Highways. Also refer to table 12 and the narrative for further explanation.

(9) Permeability indicates the rate at which water will move downward in the natural undisturbed soil. It is measured in inches percolated per hour. The rates are based on estimates made by the soil scientist.

(10) Available water capacity refers to the amount of water in the soil that can be taken up by plants. The values are estimated by the soil scientist and are measured in inches of available water per inch of soil.

(11) Reaction is the stated degree of acidity or alkalinity of the natural unlimed and unfertilized soil. Values are based on tests with the LaMotte pH indicators.

Chart 4. Interpretation of the Unified Engineering Classification System. This chart was taken from the Kentucky Highway Research Laboratory booklet on engineering properties, March, 1962.

Major Divisions (1)	(2)	Letter (3)	Name (4)	Value as Foundation When Not Subject to Frost Action (5)	Value as Base Directly under Wearing Surface (6)	Potential Frost Action (7)	Compressibility and Expansion (8)	Drainage Characteristics (9)	Compaction Equipment (10)	Unit Dry Weight (pcf) (11)	Field CBR (12)	Subgrade Modulus k (pci) (13)
Coarse-grained soils	Gravel and gravelly soils	GW	Gravel or sandy gravel, well graded	Excellent	Good	None to very slight	Almost none	Excellent	Crawler-type tractor, rubber-tired equipment, steel-wheeled roller	125–140	60–80	300 or more
		GP	Gravel or sandy gravel, poorly graded	Good to excellent	Poor to fair	None to very slight	Almost none	Excellent	Crawler-type tractor, rubber-tired equipment, steel-wheeled roller	120–130	35–60	300 or more
		GU	Gravel or sandy gravel, uniformly graded	Good	Poor	None to very slight	Almost none	Excellent	Crawler-type tractor, rubber-tired equipment	115–125	25–50	300 or more
		GM	Silty gravel or silty sandy gravel	Good to excellent	Fair to good	Slight to medium	Very slight	Fair to poor	Rubber-tired equipment, sheepsfoot roller, close control of moisture	130–145	40–80	300 or more
		GC	Clayey gravel or clayey sandy gravel	Good	Poor	Slight to medium	Slight	Poor to practically impervious	Rubber-tired equipment, sheepsfoot roller	120–140	20–40	200–300
	Sand and sandy soils	SW	Sand or gravelly sand, well graded	Good	Poor	None to very slight	Almost none	Excellent	Crawler-type tractor, rubber-tired equipment	110–130	20–40	200–300
		SP	Sand or gravelly sand, poorly graded	Fair to good	Poor to not suitable	None to very slight	Almost none	Excellent	Crawler-type tractor, rubber-tired equipment	105–120	15–25	200–300
		SU	Sand or gravelly sand, uniformly graded	Fair to good	Not suitable	None to very slight	Almost none	Excellent	Crawler-type tractor, rubber-tired equipment	100–115	10–20	200–300
		SM	Silty sand or silty gravelly sand	Good	Poor	Slight to high	Very slight	Fair to poor	Rubber-tired equipment, sheepsfoot roller; close control of moisture	120–135	20–40	200–300
		SC	Clayey sand or clayey gravelly sand	Fair to good	Not suitable	Slight to high	Slight to medium	Poor to practically impervious	Rubber-tired equipment, sheepsfoot roller	105–130	10–20	200–300
Fine-grained soils	Low compressibility LL < 50	ML	Silts, sandy silts, gravelly silts, or diatomaceous soils	Fair to poor	Not suitable	Medium to very high	Slight to medium	Fair to poor	Rubber-tired equipment, sheepsfoot roller, close control of moisture	100–125	5–15	100–200
		CL	Lean clays, sandy clays, or gravelly clays	Fair to poor	Not suitable	Medium to high	Medium	Practically impervious	Rubber-tired equipment, sheepsfoot roller	100–125	5–15	100–200
		OL	Organic silts or lean organic clays	Poor	Not suitable	Medium to high	Medium to high	Poor	Rubber-tired equipment, sheepsfoot roller	90–105	4–8	100–200
	High compressibility LL > 50	MH	Micaceous clays or diatomaceous soils	Poor	Not suitable	Medium to very high	High	Fair to poor	Rubber-tired equipment, sheepsfoot roller	80–100	4–8	100–200
		CH	Fat clays	Poor to very poor	Not suitable	Medium	High	Practically impervious	Rubber-tired equipment, sheepsfoot roller	90–110	3–5	50–100
		OH	Fat organic clays	Poor to very poor	Not suitable	Medium	High	Practically impervious	Rubber-tired equipment, sheepsfoot roller	80–105	3–5	50–100
Peat and other fibrous organic soils		Pt	Peat, humus, and other	Not suitable	Not suitable	Slight	Very high	Fair to poor	Compaction not practical			

Unified Soil Classification System Characteristics Pertinent to Road and Runway Foundations

Table 10 - Estimated Physical Properties of Soils for Engineering Interpretations

Soil Series	Drainage (1)	Depth to Rock (2)	Depth to Seasonally High Water Table (3)	Depth From Surface (4)	U.S.D.A. Texture (5)	AASHO (6)	Unified (7)	CBR Value (Optimum Moisture Content) (8)	Permeability in./hr. (9)	Available Water Capacity in./in. (10)	Reaction (11)
Allegheny	Well drained	6 to 12 ft.	5 to 8 ft.	0-18"	Fine sandy loam	A-4	ML	5 to 15	2.0-6.3	0.15-0.21	4.5-5.0
				18-41"	Sandy clay loam to clay loam	A-4 or A-6	ML-CL	5 to 40	0.63-2.0	0.13-0.17	4.5-5.0
				41-90"	Fine sandy loam	A-4	ML	5 to 15	2.0-6.3	0.10-0.15	4.5-5.0
Berks	Excessively drained	1½ to 3 ft.	N/A	0-32"	Gravelly silt loam	A-2	GM	20 to 40	2.0-6.3	0.10-0.14	4.5-5.0
Bonnie	Poorly drained	3½ to 8 ft.	0 to 6"	0-75"	Silt loam	A-4	ML-CL	5 to 15	0.63-2.0	0.17-0.18	5.1-5.5
Brookside	Well drained	5 to 9 ft.	3 ft.	0-7"	Silt loam	A-4	ML	5 to 15	0.63-6.3	0.17-0.18	6.6-7.3
				7-42"	Silty clay loam to silty clay	A-4 or A-6	ML-CL	5 to 40	0.2-0.63	0.19-0.21	6.6-7.3
				42-60"	Clay loam to clay	A-7-6	CH	5 to 40	0.06-0.2	0.14-0.18	6.6-7.3
Caneyville	Well drained	2 to 4 ft.	N/A	0-9"	Sandy loam to loam	A-4	SM	10 to 40	2.0-6.3	0.10-0.14	4.5-5.5
				9-15"	Clay loam	A-6	ML-CL	5 to 40	0.63-2.0	0.14-0.18	5.1-5.5
				15-34"	Silty clay to clay	A-7-6	CH	3 to 15	0.2-0.63	0.16-0.18	6.6-7.3
Chavies	Well drained	5 to 20 ft.	3 ft.	0-34"	Fine sandy loam	A-4	SM	20 to 40	2.0-6.3	0.12-0.16	4.5-5.0
				34-65"	Sandy loam	A-4	ML	5 to 15	2.0-6.3	0.14-0.18	4.5-5.0
Clifty	Well drained	4 to 6 ft.	1 to 2 ft.	0-18"	Silt loam	A-4	ML-CL	5 to 15	0.63-2.0	0.18-0.23	4.5-5.5
				18-50"	Gravelly silt loam	A-2	GM	20 to 80	6.3-20	0.07-0.10	4.5-5.5
Cotaco	Somewhat poorly drained	4 to 15 ft.	1 ft.	0-50"	Fine sandy loam	A-4	CL	5 to 20	0.63-2.0	0.18-0.22	6.1-6.5
Cranston	Well drained	4 to 20 ft.	N/A	0-13"	Gravelly silt loam	A-4	ML	5 to 15	0.63-2.0	0.18-0.23	4.5-5.0
				13-38"	Gravelly silt loam	A-4 or A-6	ML	20 to 80	2.0-6.3	0.14-0.18	4.5-5.0
				38-65"	Gravelly silt loam	A-4	SM	20 to 80	2.0-6.3	0.12-0.14	4.5-5.0
Cuba	Well drained	4 to 10 ft.	2 to 4 ft.	0-85"	Silt loam	A-4	ML	5 to 15	0.63-2.0	0.18-0.23	4.5-5.0
Dekalb	Somewhat excessively drained	2 to 3½ ft.	N/A	0-36"	Sandy loam	A-2 or A-4	SM	10 to 20	2.0-6.3	0.10-0.15	4.5-5.0
Elk	Well drained	6 to 10 ft.	2 to 3 ft.	0-12"	Silt loam	A-4	ML-CL	5 to 15	0.63-2.0	0.18-0.23	5.1-5.5
				12-43"	Silty clay loam	A-6	CL	5 to 15	0.2-0.63	0.15-0.19	4.5-5.0
				43-63"	Silt loam	A-4	ML	5 to 15	0.63-2.0	0.18-0.23	4.5-5.0
Gilpin	Well drained	2½ to 3½ ft.	N/A	0-10"	Silt loam	A-4	ML-CL	5 to 15	0.63-2.0	0.17-0.21	4.5-5.0
				10-17"	Silty clay loam	A-6	CL	5 to 15	0.2-0.63	0.12-0.15	4.5-5.0
				17-32"	Silt loam	A-4	ML-CL	5 to 15	0.63-2.0	0.13-0.23	4.5-5.0
Hartsells	Well drained	2 to 3 ft.	N/A	0-12"	Fine sandy loam	A-4	SM	5 to 15	2.0-6.3	0.12-0.16	4.5-5.0
				12-25"	Sandy clay loam to clay loam	A-4 or A-6	ML-CL	5 to 15	0.63-2.0	0.12-0.17	4.5-5.0
				26-36"	Sandy loam	A-2-4	ML	5 to 15	2.0-6.3	0.10-0.14	4.5-5.0
Jefferson	Well drained	5 to 8 ft.	N/A	0-17"	Sandy loam	A-4	SM	10 to 40	2.0-6.3	0.10-0.14	4.5-5.0
				17-39"	Sandy clay loam	A-4	ML-CL	5 to 40	0.63-2.0	0.14-0.18	4.5-5.0
				39-80"	Silty clay	A-7	CH	3 to 5	0.20-0.63	0.15-0.18	4.505.0
Johnsburg	Somewhat poorly drained	4 to 10 ft.	0 to 1 ft.	0-15"	Silt loam	A-4	ML	5 to 15	0.63-2.0	0.18-0.23	4.5-5.0
				15-55"	Compact silt loam or silty clay loam	A-4 or A-6	CL	5 to 15	0.06-0.2	0.10-0.14	4.5-5.0
				55-75"	Silt loam	A-4	ML-CL	5 to 15	0.2-0.63	0.18-0.23	4.5-5.0
Monongahela	Moderately well drained	6 to 10 ft.	18"	0-21"	Fine sandy loam	A-4	SM	5 to 15	2.0-6.3	0.13-0.21	6.1-6.5
				21-48"	Compact sandy clay loam or loam	A-4	ML-CL	5 to 20	0.06-0.2	0.10-0.14	4.5-5.0
				48-84"	Clay loam	A-6 or A-7	CL-CH	3 to 15	0.2-0.63	0.08-0.14	4.5-5.0
Morehead	Somewhat poorly drained	4 to 10 ft.	0 to 6"	0-70"	Silt loam	A-4	ML	5 to 15	0.63-2.0	0.18-0.23	4.5-5.0
Muse	Well drained	4 to 10 ft.	N/A	0-5"	Silt loam	A-4	ML-CL	5 to 15	0.63-2.0	0.18-0.23	5.1-5.5
				5-11"	Silty clay loam	A-6	CL	5 to 15	0.63-2.0	0.16-0.21	4.5-5.0
				11-62"	Silty clay to clay	A-7-6	CL or CH	3 to 15	0.2-0.63	0.12-0.17	4.5-5.0
Pope	Well drained	4 to 7 ft.	2 to 4 ft.	0-85"	Fine sandy loam	A-4	SM-ML	10 to 40	2.0-6.3	0.10-0.14	5.1-5.5
Ramsey	Somewhat excessively drained	1 to 1½ ft.	N/A	0-15"	Loamy sand	A-2	SM	10 to 40	2.0-6.3	0.10-0.14	4.0-5.0
Renox	Well drained	4 to 8 ft.	3 ft.	0-14"	Gravelly silt loam	A-4	ML	5 to 15	2.0-6.3	0.18-0.23	6.6-7.3
				14-35"	Gravelly silty clay loam	A-6	GC	20 to 40	0.63-2.0	0.14-0.18	6.6-7.3
				35-45"	Light silty clay loam	A-6	GM	20 to 80	0.63-2.0	0.10-0.14	6.6-7.3
Robertsville	Poorly drained	4 to 10 ft.	0 to 6"	0-9"	Silt loam	A-4	ML	5 to 15	0.63-2.0	0.18-0.23	5.1-5.5
				9-60"	Compact silty clay loam	A-6	CL	5 to 15	0.06-0.2	0.19-0.21	4.5-5.0
Shelocta	Well drained	4 to 9 ft.	N/A	0-14"	Silt loam	A-4	ML-CL	5 to 15	0.63-2.0	0.18-0.23	4.5-5.0
				14-36"	Silty clay loam	A-6	CL	5 to 15	0.2-0.63	0.10-0.15	4.5-5.0
				36-64"	Silty clay loam to silty clay	A-7	CH	3 to 15	0.06-0.2	0.10-0.15	4.5-5.0
Shoals	Poorly drained	4 to 8 ft.	0 to 6"	0-45"	Fine sandy loam	A-4	SM	5 to 15	0.63-2.0	0.14-0.18	6.6-7.3
Stendal fine sandy loam (185)	Somewhat poorly drained	4 to 8 ft.	0 to 1 ft.	0-38"	Fine sandy loam	A-4	SM-ML	5 to 40	0.63-2.0	0.14-0.18	4.5-5.0
Stendal silt loam (184)	Somewhat poorly drained	4 ft.	0 to 1 ft.	0-55"	Silt loam	A-4	ML	5 to 15	0.63-2.0	0.15-0.18	4.5-5.0
Talbott	Well drained	2 to 3 ft.	N/A	0-3"	Silty clay loam	A-6	CL	5 to 15	0.2-0.63	0.10-0.15	7.4-7.8
				3-31"	Silty clay to clay	A-7-6	CH	5 to 15	0.06-0.2	0.08-0.12	6.6-7.3
Tilsit	Moderately well drained	3½ to 15 ft.	1 ft.	0-25"	Silt loam	A-4	ML	5 to 15	0.63-2.0	0.17-0.21	4.5-5.0
				25-75"	Compact silt loam	A-4	CL	5 to 15	0.06-0.2	0.11-0.15	4.5-5.0
				75-120"	Silt loam	A-4	CL	5 to 15	0.63-2.0	0.14-0.19	4.5-5.0
Wharton (Trappist is included)	Well drained	2½ to 3½ ft.	N/A	0-6"	Silt loam	A-4	ML	5 to 15	0.63-2.0	0.18-0.23	4.5-5.0
				6-36"	Silty clay loam to silty clay	A-7-6	CH	3 to 15	0.2-.63	0.09-0.12	4.5-5.0
Whitley	Well drained	3 to 4 ft.	N/A	0-12"	Silt loam	A-4	CL	5 to 15	0.63-2.0	0.18-0.23	4.5-5.0
				12-30"	Light silty clay loam	A-6	CL	5 to 15	0.63-2.0	0.19-0.21	4.5-5.0

Table 11 Interpretations of Engineering Properties of the Soils

Table 11 shows interpretations and soil features that affect the use of the different soils in construction and other engineering practices. Ratings or particular characteristics or qualities of the soils are listed under the common uses for the areas. The statements are derived from information listed in table 10 of this section, from available test data, and from field experience.

Most of the information in table 11 is self-explanatory, but the heading of each column is briefly defined in the following narrative.

(1) Topsoil refers to the surface layer of the soil that is rich in organic matter and generally used as a topdressing for recreation areas, roadsides or lawns. The ratings indicate the suitability for these uses.

(2) Sand and Gravel ratings are based on the soil texture and depth. Sand deposits are scarce and the quality is generally low. Gravel material underlies soil material in several bottom soils. Creek beds are a common source of gravel and tend to "fill up" with gravel each spring.

(3) Road fill is the material used as an embankment to support the sub-base and base course or surface course. Suitability ratings for road fill material are based on the performance of the soil material when excavated and used as borrow for highway subgrade. The best materials in the area are sand/clay mixtures and the poorest are plastic clays.

(4) Highway location. Highlighted here are critical soil features of the undisturbed natural soil that affect highway construction and maintenance. These features affect design and geographic location of roads.

(5) Cut bank stability concerns the ability of the cut soil to resist slumping and eroding. Primary factors include soil depth, drainage, slope and texture. Cut bank stability is an important consideration in road construction.

(6) Winter grading concerns the suitability of the soils for supporting construction equipment and the ease with which the soil can be moved during the cold months.

(7) Ponds - Reservoir area. Features here are those that affect the use of the natural undisturbed soil for an impoundment. Of primary concern are the seepage rates and erodibility.

(8) Ponds - Embankments. This concerns the probable behavior and features affecting disturbed soil material excavated and placed for a pond embankment. Of primary concern are the piping hazards and compaction characteristics.

(9) Grassed Waterways. The features and qualities of soils considered here are those that affect the establishment and growth of plants and those factors affecting the construction of the waterway.

(10) Foundations for low buildings. Listed here are soil features and qualities of the undisturbed soil that affect the construction and maintenance of foundations and their capacity to support low buildings.

(11) Septic tank filter fields. Permeability, water table depth, and susceptibility to flooding are primary soil factors that affect the functioning of septic tank filter fields.

Table 11 Interpretation of Engineering Properties of the Soils

Soil Series	Suitability as a source of: Topsoil (1)	Sand and Gravel (2)	Road fill (3)	Highway Location (4)	Cut Bank Stability (5)	Winter Grading (6)	Soil Features Affecting: Reservoir Area (7)	Embankment (8)	Grassed Waterways (9)	Foundations for Low Buildings (10)	Septic tank Filter fields (11)
Allegheny	Good	Generally poor; sand below 3 ft. in some places.	Good	Seasonal water table at about 2 feet.	Stable	None	None	None	None	Seasonal high water table at about 3 ft.	Moderate permeability
Berks	Poor; thin gravelly.	Unsuitable; excessive fines.	Good-if soil binder is added	Bedrock at about 3 ft. very steep slopes.	Stable	Steep Slopes	Rapid permeability; fractured bedrock.	Susceptible to piping; rapid seepage.	Steep slopes, low available moisture.	Bedrock at about 3 ft. steep slopes.	Steep slopes; creviced bedrock.
Bonnie	Poor; wetness makes it difficult to obtain.	Unsuitable; excessive fines.	Fair to Good	Seasonal water table at surface.	Unstable; poor drainage.	High water table.	Subject to frequent flooding.	Poor compaction characteristics; piping hazard.	Poor internal drainage.	High water table permanently.	High water table permanently near surface.
Brookside	Poor; topography and stoniness makes it difficult to obtain.	Unsuitable	Poor; highly plastic; high shrink-swell potential.	Steep slopes; high slump hazard; low bearing capacity.	Unstable; slump.	Soils highly plastic when wet; difficult to excavate.	Steep slopes	Clayey material high volume change; poor compaction characteristics.	Cuts will expose highly erodible material.	Slump hazard high shrink-swell potent.	Steep slopes.
Caneyville	Poor; stones and rocks.	Poor; excessive fines.	Poor to fair; high shrink-swell.	Rock at about 3 ft.	Unstable; slump.	Soil plastic when wet.	Cavernous bedrock.	Rockiness and stoniness.	Rockiness and stoniness.	Bedrock at about 3 ft.	Bedrock at about 3 ft. Slow permeability.
Clifty	Fair; gravelly	Good for gravel below 18 in.	Fair; gravelly and stony.	Subject to occasional flooding.	Unstable; gravelly materials.	High water table during winter months.	Rapid permeability.	Piping hazard rapid seepage.	Gravelly; nearly level.	Occasional flooding; rapid permeability.	Rapid permeability can cause pollution.
Chavies	Good	Generally poor; excessive fines. In places, fair for sand below 3 feet.	Good	Subject to occasional flooding.	Stable	High water table during winter months.	Pervious material below 3 feet in places.	Fair compaction; piping hazard.	Nearly level.	Occasional flooding.	High seasonal water table at about 2½ feet.
Cotaco	Good	Unsuitable, excessive fines.	Fair to Good	Subject to occasional flooding.	Unstable; poor drainage.	High water table during winter months.	Pervious material.	Fair stability; piping hazard.	Somewhat poorly drained.	Seasonal high water table.	Seasonal high water table at about 1 ft.

Cranston (B1 and C1)	Fair; gravelly.	Generally poor; stone and excessive fines. In places, fair for gravel below 3 ft.	Good	Seasonal high water table.	Stable	High water table during winter months.	Pervious material.	Fair compaction; Piping hazard.	Siltation of channels; gravelly material.	Seasonal high water table.	Seasonal water table at about 3 ft.
Cranston (D1, E1, F1)	Fair; some stones, gravelly; difficult to obtain because of slope.	Unsuitable; stone and excessive fines.	Good	Susceptible to slides or slumps.	Unsuitable; steep slopes.	Steep slopes.	Pervious material.	Fair compaction; piping hazard.	Steep slopes; siltation of channels.	Susceptibility to sliding.	Steep slopes.
Cuba	Good	Unsuitable; excessive fines.	Fair to Good	Subject to frequent flooding.	Unstable; floods.	High water table during winter months.	Subject to frequent flooding.	Poor compaction; piping hazard.	Nearly level.	Frequent flooding.	Subject to flooding in most springs.
Dekalb	Fair; Thin	Fair for sand; about 3 feet to bedrock.	Good	Bedrock at about 3 feet; rocky surface.	Stable	None	Pervious material.	Sandy material; rapid seepage rate.	Droughty soil.	Bedrock at about 3 ft.	Rapid permeability; bedrock at about 3 ft.
Elk	Good	Unsuitable; excessive fines.	Fair to Good	Subject to occasional flooding.	Stable	Seasonal high water table during winter months.	None	None	Nearly level.	Seasonal high water table.	Subject to occasional flooding.
Gilpin	Fair; Thin	Unsuitable; excessive fines.	Fair to Good	Erodible soil material. Shale or siltstone at about 3 feet.	Stable	Low stability on freezing and thawing.	About 3 feet to bedrock.	None	Siltation of channels.	Shale or siltstone bedrock at about 3 ft.	Bedrock at about 3 ft.
Hartsells	Good	Poor; excessive fines, about 3 feet to sandstone rock.	Good	Bedrock at about 3 ft.	Stable	None	Bedrock at about 3 ft.	Fair compaction; piping hazard.	Maybe droughty.	Bedrock at about 3 ft.	Bedrock at about 3 ft.
Jefferson (43F1, 793E1, F1)	Poor; stony surface; rough topography.	Poor; excessive fines.	Fair; large stone and boulders throughout the soil.	Slump hazard stones and boulders.	Unstable; slumps.	None	Steep slopes.	Common stones and boulders throughout; soil piping hazard.	Steep slopes.	Slump hazard.	Slopes and stoniness.

Jefferson (41B1, C1, D1, E1 F1; 793C1)	Good; topography may make it difficult to obtain.	Poor; excessive fines.	Good	Slump hazard	Stable	None	Steep slopes	None	Moderately steep slopes.	Moderately steep slopes.	Steep slope.
Johnsburg	Fair; wetness in spring makes it difficult. to obtain.	Unsuitable excessive fines.	Fair to Good	Seasonal high water table.	Stable	Seasonal high water table.	Seasonal high water table.	Poor compaction characteristics; piping hazard.	Nearly level.	Seasonal high water table.	Fragipan; seasonal high water table.
Monongahela	Good	Generally poor; excessive fines. Fair for sand below 3 ft. in some places.	Good	Seasonally perched water table.	Stable	Water table perched above fragipan in winter months.	None	Sandy materials below 3 ft. in places; piping hazard.	Cuts may expose dense fragipan subsoil.	Seasonal high water table.	Fragipan seasonal high water table.
Morehead	Fair; wetness in spring makes it difficult to obtain.	Unsuitable excessive fines.	Fair to Good	Seasonal high water table.	Unstable; poor drainage.	High water table.	Seasonal high water table.	Poor compaction characteristics.	Nearly level.	Subject to occasional flooding; seasonal high water table.	Seasonal high water table.
Muse (B1 and C1)	Fair; removal exposes erodible subsoil.	Unsuitable excessive fines.	Fair to Poor; moderate shrink-swell; erodible.	Erodible soil material when exposed; has low bearing capacity.	Unstable; erodible.	Soil plastic when wet.	None	None	Clayey subsoil; highly erodible.	Moderate shrink-swell potential.	Slow permeability.
Muse (D1, E1, F1)	Poor; topography makes it difficult to obtain.	Unsuitable excessive fines.	Fair to Poor; moderate shrink-swell, erodible.	Slump hazard.	Unstable erodible and subject to slump.	Soils plastic when wet.	None	None	Steep slopes; clayey subsoil; highly erodible.	Slump hazard.	Slow permeability; steep slopes.
Pope	Good; some areas gravelly.	Good for sand in most places; some places are gravelly or have excessive fines.	Good if a soil binder is added.	Subject to frequent flooding.	Unsuitable; floods.	Seasonal high water table.	Rapid permeability.	Piping hazard; material unstable.	Nearly level; gravelly in places.	Seasonal high water table.	Subject to frequent flooding.
Ramsey	Poor; thin, rocky.	Fair for sand; shallow.	Poor; rocky and non sufficient material.	1½ feet to bedrock.	Stable	None	Rapid permeability.	Rapid seepage.	Rocky, droughty soil; shallow.	1½ feet to bedrock.	Insufficient storage space.
Renox	Good	Unsuitable; excessive fines.	Fair to Good	Seasonal high water table.	Stable	None	Pervious material, high seepage rate.	Piping hazard.	None	Seasonal high water table.	Gravelly subsoil in places could cause pollution.

Robertsville	Poor; wetness makes it difficult to obtain.	Unsuitable; excessive fines.	Fair to Good	High water table.	Unstable; seepage.	None	High water table.	Poor compaction characteristics. Piping hazard.	Poorly drained.	High water table; restricted internal drainage.	High water table; restricted internal drainage by fragipan.
Shelocta	Poor; topography makes it difficult to obtain.	Unsuitable; excessive fines.	Good	Slump hazard.	Unstable; slumps.	Soil plastic when wet.	Steep slopes.	Some stones and cobbles; piping hazard.	Steep slope.	Slump hazard.	Steep slopes.
Shoals	Fair; wetness makes it difficult to obtain.	Unsuitable; excessive fines.	Good	High water table; subject to frequent flooding.	Unstable; seepage.	Seasonal high water table; somewhat poorly drained.	High water table.	Fair stability; pervious material.	Nearly level poor drainage.	Seasonal high water table.	Somewhat poorly drained; subject to flooding.
Stendal (185)	Fair; wetness makes it difficult to obtain.	Fair to sand in places, some areas have excessive fines.	Fair to good if a soil binder is added.	High water table; subject to frequent flooding.	Unstable; seepage.	Seasonal high water table some what poorly drained.	High water table.	Pervious materials; piping hazard.	Nearly level poor drainage.	Seasonal high water table.	Somewhat poorly drained; subject to flooding.
Stendal (184)	Fair; wetness makes it difficult to obtain.	Unsuitable; excessive fines.	Fair	High water table; subject to frequent flooding.	Unstable; seepage.	Seasonal high water table some what poorly drained.	High water table.	Poor compaction; piping hazard.	Nearly level poor drainage.	Seasonal high water table.	Somewhat poorly drained; subject to flooding.
Talbott (707C1, 707E1)	Poor; rockiness makes it difficult to obtain.	Unsuitable	Poor; highly plastic; high shrink swell potential.	Rocky surface low bearing capacity.	Unstable; exposed soil is highly erodible.	Soils highly plastic when wet; difficult to excavate.	Cavernous bedrock that would allow seepage.	Clayey material; high volume change; poor compaction characteristics.	Rocks throughout profile; highly erodible material.	Bedrock at about 3 ft. rocky surface; high shrink swell material.	Slow permeability in dense clayey subsoil; bedrock at 3 ft. rocky surface.
Tilsit (86B1, 86C1)	Good	Unsuitable; excessive fines.	Good	Seasonal high water table perched by fragipan	Unstable; seepage.	Perched water table during winter months.	None	None	None	Perched water table during winter months.	Slow permeability due to fragipan; seasonal high water table.
Wharton (Includes Trappist)	Fair; erodible subsoil.	Unsuitable; excessive fines.	Fair to poor; moderate shrink swell, erodible.	Shale and siltstone at about 3 ft. Erodible soil material when exposed.	Unstable; erodible.	Soils plastic when wet.	None	None	Steep slopes; clayey subsoil; highly erodible.	About 3 ft. to rock; slump hazard.	Slow permeability. About 3 ft. to bedrock.
Whitley	Good	Unsuitable; excessive fines.	Good	Shale or siltstone at about $3\frac{1}{2}$ ft.	Stable	Low stability on freezing and thawing.	None	None	None	Shale rock at about $3\frac{1}{2}$ ft.	Shale rock at $3\frac{1}{2}$ ft.

Table 12 Laboratory Data on Physical Properties of Several Soils

Table 12 presents engineering test data for soil samples taken on extensive or major soils in the survey area. The Soil Management Report for the Southern Portion of the Daniel Boone (pages 40,41, 42) contains test data on some soils not presented in this report and this information should be referred to when necessary. The samples were analyzed by the Kentucky Highway Research Laboratory in Lexington, Kentucky where a file is kept on soil test data throughout the state. Particle size and chemical analysis of some soils are presented in section H of this report.

The following narrative explains the columns in table 12. The table shows the depth to which sampling was done, and the results of tests to determine particle-size distribution and other properties significant in soil engineering. The first seven columns are self-explanatory.

Dry density is the maximum unit dry weight of the soil when it has been compacted with optimum moisture by the prescribed method of compaction. The moisture content which gives the highest dry unit weight is called the optimum moisture content for the specific method of compaction.

CBR - California Bearing Ratio. A modified punching shear test was developed by the California Division of Highways in which a piston of 3-in. end area is forced into compacted samples of 6-in. diameter. There is no opening in the bottom of the specimen mold to permit extrusion of material. Rate of piston movement is controlled and pressure readings are taken for various penetration depths. The standard of comparison for computing a material's bearing value is the following relation between penetration and load or pressure on a "standard" well-graded crushed stone.

Penetration, in.	Standard load, psi
0.1	1,000
0.2	1,500
0.3	1,900
0.4	2,300
0.5	2,600

The bearing value of a sample is determined for a specific penetration by dividing the load for that penetration by the standard load for the same penetration. For example, if a specimen requires a load of 450 psi to obtain 0.1-in. penetration, its bearing value will be (450/1,000) x 100 = 45 per cent. This bearing value has become known as the California Bearing Ratio, generally abbreviated to CBR, with the "per cent" omitted. Both soaked and unsoaked figures are given.

Specific gravity is the particle density or weight per unit volume (expressed in gms. per cubic centimeter) of the soil particles. This property is relatively constant in our mineral soils, whether the particles are clay or sand. The weight per unit volume of the soil as it occurs under field conditions, including pore space, is known as bulk density and is also expressed in grams per cubic centimeter. The water Management section of this Report discusses bulk density as it relates to land use and textural class. Bulk density has greater practical significance than specific gravity.

Mechanical analyses show the percentages, by weight, of soil particles that would pass sieves of specified sizes. Sand and other coarser materials do not pass through the No. 200 sieve. Silt and clay pass through the No. 200 sieve. Silt is that material larger than 0.002 millimeter in diameter that passes through the No. 200 sieve, and clay is that fraction passing through the No. 200 sieve that is smaller than 0.002 millimeter in diameter. The clay fraction was determined by the hydrometer method, rather than the pipette method most soil scientists use in determining the clay in soil samples.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a solid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from solid to plastic. The liquid limit is the moisture content at which the material changes from plastic to liquid. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

The AASHO and Unified classifications have been explained earlier in the engineering section.

Table 12 Laboratory Data on Physical Properties of Several Soils Sampled for Kentucky Materials Research Laboratory

Soil Series	Percent Slope	Parent Material	Depth to Bedrock (in.)	Depth from Surface Top	Depth from Surface Bottom	Horizon	lbs/ft.^{3} Dry Density	Percent Optimum Moisture	CBR Data un-soaked	CBR Data Soaked	gms./cc. Specific Gravity	Mechanical Analysis-Percent Passing Sieve 1½ in.	1 in.	3/4 in.	3/8 in.	No. 4	No. 10	No. 40	No. 60	No. 200	Percentage smaller than .05mm	.02mm	.005mm	.002mm	L.L.	P.I	AASHO	Unified
Berks silt loam	58	Acid silt stone	26	12	26	B2	113	13	99	46	2.77	98	87	79	65	58	49	43	42	40	27	18	6	3	NP	NP	A-4(0)	SP-SM
Berks silt loam	56	Acid silt stone	38	11	28	B2	116	14	76	45	2.69	14	92	88	78	72	64	55	54	49	39	33	10	6	NP	NP	A-4(0)	SM-SP
Brookside silt loam	37	Shale, lime-stone, sand-stone colluvium	60+	24	35	B22T	103	20	17	4	2.72		100	99	96	95	92	88	86	71	66	59	45	42	45	20	A-7-6(12)	CL
				42	60	C	109	18	13	5	2.75	100	98	96	93	91	90	86	82	65	57	49	39	34	39	18	A-6(9)	CL
Brookside silt loam	46	Shale, lime-stone, sand-stone colluvium	60+	19	30	B21T	109	16	43	3	2.70	100	99	99	97	95	93	87	83	75	67	59	41	32	37	15	A-6(10)	CL
				42	60+	B3T	109	17	28	3	2.74	100	99	99	98	96	94	89	86	80	72	63	47	38	39	16	A-6(10)	CL
Cranston silt loam	55	Acid silt stone colluvium	50+	23	31	B22T	115	15	56	41	2.69	100	99	95	86	80	73	63	61	56	45	34	16	9	NP	NP	A-4(0)	ML
				38	50+	B32T	117	14	92	31	2.73	100	99	95	81	70	58	50	49	45	34	24	14	10	25	5	A-4(2)	SM
Cranston silt loam	33	Acid silt stone colluvium	70+	17	32	B21T	113	12	99	56	2.74	100	97	92	79	67	57	52	51	48	35	23	12	8	NP	NP	A-4(0)	SM-SP
				51	70+	B3	113	16	77	48	2.71	100	98	95	84	75	64	58	58	54	31	23	15	12	NP	NP	A-4(0)	ML
Jefferson fine sandy loam	27	Sandstone, shale colluvium	78+	24	38	B22T	113	16	15	17	2.72	99	98	98	97	96	90	85	82	57	44	37	23	18	28	12	A-6-6(5)	CL
				63	78+	C1	105	17	61	3	2.77		100	99	96	87	73	68	65	57	54	50	35	26	42	17	A-7-6(7)	CL
Jefferson sandy loam	34	Sandstone colluvium over shale	80+	17	32	B22T	121	12	55	30	2.67	99	98	96	93	87	80	72	56	34	30	27	18	14	NP	NP	A-2-4(0)	SP-SM
				48	80+	C	104	18	35	3	2.78	100	99	98	95	90	74	71	67	62	59	53	37	28	46	20	A-7-6(10)	CL
Shelocta silt loam	26	Shale colluvium	64+	26	36	B22T	105	20	34	6	2.75			100	99	97	90	86	85	80	71	59	35	25	36	12	A-6(9)	CL
				47	64+	C	97	25	36	3	2.81			100	99	98	95	92	91	89	83	76	62	51	55	23	A-7-5(16)	MH
Talbott silty clay loam	12	Limestone	31	13	25	B22T	93	27			2.75			100	99	99	98	96	91	84	80	71	50	38	60	27	A-7-5(19)	MH
Tilsit silt loam	4	Acid shale, siltstone colluvium	71	21	35	BX1	109	18	60	12	2.72		100	99	97	94	93	92	92	90	74	55	34	26	NP	NP	A-4(0)	ML
				56	71	B3T	109	18	54	5	2.71			100	99	99	99	98	97	96	76	58	29	20	NP	NP	A-4(0)	ML
Tilsit silt loam	3	Acid shale	46	19	33	BX1	114	13	62	13	2.67				100	99	96	94	92	78	71	5	30		22	6	A-4(8)	CL-ML
Wharton silt loam	7	Acid shale	42+	18	33	B3T	111	16	35	3	2.77	100	99	98	97	96	92	90	89	86	70	56	34	26	32	13	A-6(9)	CL-CL
Wharton silt loam	12	Acid silt stone	38	20	29	B22T	104	19	34	3	2.78			100	99	99	99	98	98	97	91	81	55	42	43	18	A-7-6(12)	CL

G. Argronomic Interpretations

This section is provided to help the land manager establish plants such as grasses and legumes on special areas. Providing a turf is often an important part of stabilizing road banks and cleared areas on National Forest land.

Soil tests should be made on each area to determine the actual needs of the particular site in mind. If soil test information is not available, the attached chart provides a rule of thumb guide for lime and fertilizer applications on the Ranger Districts.

Table 13

Wildlife Clearings and Roadsides

The relative ratings are based on the growth characteristics of each plant species under the specified conditions. Example: A shade tolerant, perennial species which begins growth early in the spring and stays green late in the fall is rated good for wildlife clearing and roadsides.

Erosion Control

Quick-cover revegetation usually involves cuts and fills, eroded, scalped, or compacted areas, overturned soils, and inclusions of slightly weathered bedrock or other materials which are not soil. Except under extremely acid conditions the surface of such areas to be seeded should be scarified to attain a better seed bed, and to incorporate lime and fertilizer.

Play Fields (Extensive Play and Picnic Areas)

Dense, uniform turf necessitates heavy seeding and heavy maintenance applications of fertilizers. Without this care and frequent clippings, turf will thin out, become ragged and weedy, and show earlier signs of foot wear. Soil test information should be used to determine succeeding maintenance applications.

Extremely Difficult Conditions

Extreme acidity, very steep slopes, dry sites, and low natural fertility, alone or in combination, produce situations where seeding and planting with ordinary preparations will not succeed. Mixing large amounts (up to 20 tons per acre) of limestone into the upper 12 inches of a soil will partially but temporarily overcome extreme acidity. Mulching of dry sites with straw (1 bale to 1000 square feet) or woodchips will aid in moisture retention and successful revegetation. The depth of mulch and time of application should not inhibit the species desired as cover. Large revegetation projects should have on-site evaluation.

Table 13 Grass - Legume Planting and Fertilizer Recommendations for Soils Under Special Uses

Soil Suitability Group	Plant Species	Planting Rate Lbs/Acre			Planting Time 1/	Starter Fertilizer Lbs/Acre	& Formula	Wildlife		Erosion Control	Play Fields	Extreme Condition
	Grass Species	Alone	In Mixes	Turf				Clearing	Roadside			
1 4 5 7 8 9	Kentucky Blue Grass		8-12	40	Spring, Fall	1000	12-12-12	Good	Good	N.R. 3/	Good	N.R. 3/
1 4 5 7 8 9 10	Orchard Grass	10-15	6-8		Spring, Fall	1000	12-12-12	Good	Good	Fair	N.R. 3/	N.R.
1 3 4 5 6 7 8 9 10 11 12 13	Red Top	3-6	2-5		Spring, Fall	1000	12-12-12	Good	Good	Good	Fair	Fair
2 5 7 9 10 11 12 13	Canada Blue Grass		8-12	40	Spring, Fall	1000	12-12-12	Fair	Good	Fair	Fair	Fair
1 4 5 7 9 11	Brown Topped Millet	20-30	15-20		Spring, Summer	1000	12-12-12	Fair	Good	N.R.	N.R.	N.R.
1 2 3 4 5 6 7 8 9 10 11 12 13 14	Ky-31-Fescue	10-30	8-15	60-80	Spring, Fall	1000	12-12-12	N.R. 3/	N.R.	Good	Fair	Good
1 3 4 5 7 8 9	Bermuda Grass	8-15	2-4		Spring	1000	12-12-12	N.R.	Fair	Good	Good	N.R.
1 2 3 4 5 7 8 9 10 11 12 13	Creeping Red Fescue	25-30	5-8	30-45	Spring, Fall	1000	12-12-12	N.R.	N.R.	N.R.	Good	N.R.
2 11 12 13 14	Weeping Love Grass	5	2-3		Spring	1000	12-12-12	N.R.	N.R.	Good	N.R.	Good
2 3 8 11 12 13 14	Little Bluestem	15	6-8		Spring	1000	12-12-12	N.R.	N.R.	Fair	N.R.	Fair
2 3 8 11 12 13 14	Kaw Big Bluestem	15	6-8		Spring	1000	12-12-12	N.R.	N.R.	Fair	N.R.	Fair
3 6	Reed Canary	10-12	4-8		Spring, Fall	1000	12-12-12	N.R.	Good	Good	N.R.	Good
1 4 5 7 8 9 10	Timothy	10-12	6-8		Spring, Fall	1000	12-12-12	Good	Good	Fair	N.R.	Good
1 2 3 4 5 6 7 8 9 10 11 12 13 14	Velvet Grass	8	6-8	8	Spring, Fall	1000	12-12-12	Exc.	Exc.	Good	N.R. 3/	Fair
	Nurse and Quick Cover Species											
1 4 5 7 8 9 12	Oats (Winter or Spring)	64-128	32		Spring, Fall	1000	12-12-12	Good	Fair	Fair	Fair	Fair
2 3 6 10 11 13 14	Balboa Rye	112-168	56		Fall	1000	12-12-12	Fair	Good	Good	Fair	Good
1 3 4 5 7 8 9	Wheat	60-120	30		Fall	1000	12-12-12	Good	Good	Fair	Fair	Fair
1 2 3 4 5 6 7 8 9 10 11 12 13 14	Annual Rye Grass	20	4-6		Spring, Fall	1000	12-12-12	Good	Good	Good	Good	Good
	Legume Species 2/											
1 2 4 5 7 8 9 10 11 12 13	Korean Lespedeza	15-25	Nurse		Spring	1000	5-20-20	Fair	Good	Poor	N.R.	Poor
1 3 4 6 8 9 11	White Dutch Clover	3-5	½-2		Spring, Fall	1000	5-20-20	Good	Fair	Poor	Fair	N.R.
1 3 4 6 8 9	Ladino Clover	3-5	½-2		Spring, Fall	1000	5-20-20	Fair	Good	Poor	Poor	N.R.
1 4 5 7 8 9	Red Clover	8-12	Nurse		Spring, Fall	1000	5-20-20	Fair	Fair	Poor	N.R.	N.R.
1 2 4 7 8 9 10 11 12 13 14	Serecia Lespedeza	30 (Scarified Seed)			Spring	1000	5-20-20	Fair	Good	Good	N R.	Good
2 10 11 12 13 14	Crown Vetch	5-15	Nurse		Spring	1000	5-20-20	N.R.	N.R.	Good	N.R.	Good
3 6 8	Alsike Clover	4-5	2-3		Spring, Fall	1000	5-20-20	Good	Good	N.R.	Fair	Fair
	Grass-Legume Mixtures 2/											
1 4 5 7 8	Kentucky Blue Grass and White Dutch Clover		8-15 ½-2	40 24	Spring, Fall	1000	5-20-20	Good	Fair	N.R.	Good	N.R.
3 6 8 11 12 13	Orchard Grass and White Dutch Clover		6-8 ½-2	30 18	Spring, Fall	1000	5-20-20	Fair	Good	Fair	Poor	N.R.
2 3 6 8 9 10 11 13 14	Ky-31-Fescue and Ladino Clover		8-15	40	Spring, Fall	1000	5-20-20	Fair	Good	Good	Fair	Fair
1 2 4 5 7 8 9 10 11 12 13 14	Ky-31-Fescue and Serecia Lespedeza		15	30	Spring	1000	5-20-20	Good	Good	Good	Good	Good
1 2 3 4 5 6 7 8 9 10 11 12 13 14	Velvet and White Dutch Clover		8 2		Spring, Fall	1000	5-20-20	Good	Good	Good	N.R. 3/	Fair

1/ Spring planting dates are February 15 to April 15; Fall dates are August 15 to October 1. Preferred dates are underlined.
2/ All legume seed should be inoculated with the proper culture.
3/ N.R. = Not Recommended.

Table 14

Maintaining Fertility

Areas initially revegetated in conjunction with lime and fertilizer applications should receive maintenance applications. Table 14 "Soil Group Fertility Maintenance Recommendations" lists frequency, kind, and rates by soil group. THESE RECOMMENDATIONS ARE MADE IF SOIL TESTS ARE NOT AVAILABLE. Choice of fertilizers can be used to stregthen either the grass or legume component. If the legume is thinning out, a low nitrogen fertilizer is recommended. If the reverse condition exists (grass thinning out), fertilize with nitrogen.

AGRONOMIC SOIL GROUPS FOR TABLES 13 AND 14

1	2	3
490B1, C1, D1; 377C1; 44B1, C1; 40B1, C1, D1; 842D3	878G1; 857D1, E1; 805D1; 813F1; 011	184; 480; 185; 286; 112, 46B1; 47B1
4	5	6
133; 181A, A2; 297; 237; 380A1, B1; 283; 16A, C; 116A	83C1, D1; 864B1, C1, D1; 805B1, C1; 836C1; D1; 857C1; 80C1, D1	191; 390; 387A
7	8	9
379A1, B1; 377B1; 180; 10A, C	86B1, C1; 383B1, C1	376B1, C1, D1; 41B1, C1, D1; 793C1; 335B1, C1, D1; 339B1; 332B1, C1; 725D1; 725D3
10	11	12
332D1; 438D1; 892C1, D1, D3; 882C1, D1; 803C1, D1; 821D1, D3; 825C1, D1	444F1; 707C1, E1; 723E1, F1, G1; 704C1; 725C1, C2, D2	41E1, F1; 43F1; 793E1, F1; 725E1, E3, F1; 492F1
13	14	
882E1; 892E1; 438E1, F1; 490E1, F1; 80E1, F3; 864E1; 842E1, F1; 81E1, E3; 840F1, F3, 61; 867F1; 883E1, F1	043	

TABLE 14 SOIL GROUP FERTILITY MAINTENANCE RECOMMENDATIONS

MAINTENANCE APPLICATION

Group Number	Frequency of Maintenance Applications and Soil Tests	Limestone Ground Agricultural (Initial and Maintenance Application)	Commercial Fertilizer		
			For Grass Formula 12-12-12	For Legumes Formula 5-20-20	For Grass-Legume Mixture Formula 5-20-20
	Years	Tons/Acre	Lbs./Acre	Lbs./Acre	Lbs./Acre
1	3	3	500	200	200
2	2	2	600	300	300
3	2	2	600	300	300
4	3	3	500	250	250
5	3	2	500	250	250
6	1	2	600	300	300
7	3	3	500	250	250
8	3	2	500	250	250
9	3	2	500	250	250
10	3	4	600	300	300
11	2	2	400	200	200
12	3	2	600	300	300
13	2	4	600	300	300
14	1	2	600	300	300

H. Laboratory Data on Selected Soils 1/

Chemical analysis and particle size distribution is presented in this section for eight (8) major soil series. Representative profiles were sampled and analyzed to gain more precise information needed to classify and interpret our forested soils. The basic data is presented here so that engineers, watershed specialists, and timber management specialist, soil scientists, and others can evaluate and reinterpret this soil survey as research and technology change our concepts, methods, and direction in land management.

Chemical Data Abbreviations pH - soil reaction, determined by two methods, use H_2O method; Base Sat. - Base Saturation; CEC - Cation Exchange Capacity; Ca, Mg, K, Na - calcium, magnesium, potassium, and sodium, respectively; TEB - Total Exhangeable Bases; $CaCo_3$ - Calcium carbonate; O.M. - organic matter; Sol P - Soluble phosphorous.

Particle Size Distribution VCS - very coarse sand; CS - coarse sand; MS - medium sand; FS - fine sand; VFS - very fine sand; Silt - silt; Tot C - Total clay; Textural class - Sil - silt loam; Sicl - silty clay loam; Sic - silty clay; C - clay; L - loam; LS - loamy sand; SL - sandy loam; SCL - sandy clay loam; CL - clay loam.

1/ Analysis by Dr. H. H. Bailey, Associate Professor of Agronomy, University of Kentucky, Lexington.

SOIL PHASE: Brookside silt loam PROFILE NUMBER: S65-Ky-102-

CHEMICAL DATA

Sub No.	Horizon	Depth inches	pH		Base Sat. (%)	meg/100 grams of soil						$CaCO_3$ eq.%	O.M. (%)	S F #/A pp
			H_2O	Salt		CEC	Ca	Mg	K	Na	TEB			
-1	A1	0-4	6.9	5.85	37.9	14.20	2.85	2.04	0.30	0.19	5.38	0.45	4.26	8.0
-2	A2	4-10	5.9	4.42	26.9	11.06	1.25	1.38	0.14	0.20	2.97	0.26	1.28	3
-3	B1t	10-16	5.8	4.37	38.6	13.28	2.0	2.09	0.15	0.88	5.12	0.42	0.93	1
-4	B21t	16-24	6.0	4.80	33.8	15.77	1.75	3.13	0.25	0.20	5.33	0.18	0.68	1.0
-5	B22t	24-36	6.0	4.86	35.3	20.34	0.38	6.17	0.41	0.22	7.18	0.15	0.69	0
-6	B3t	36-50	6.1	4.82	46.3	28.63	2.72	9.6	0.38	0.55	13.25	0.20	0.65	1.0
-7	C	50-72	6.2	5.00	56.3	21.99	3.0	8.16	0.32	0.89	12.37	0.23	0.82	1
	R	72+	Calcareous shale											

PARTICLE SIZE DISTRIBUTION IN %: Pipette (X) Wells, Hydrometer ( ), Fractionation( )

Sub No.	VCS 2-1mm	CS 1-.5mm	MS .5-.25	FS .25-.1	VFS .1-.05	Total Sand	Silt .05-002m	Tot.C <.002mm	Textural Class
-1	1.62	1.36	0.68	8.83	9.39	21.88	56.48	21.64	sil
-2	1.59	1.13	.87	8.88	9.05	21.52	54.12	24.36	sil
-3	1.74	1.17	.83	8.24	8.53	20.51	50.28	29.21	cl/sicl
-4	3.86	1.37	.73	7.78	7.95	21.69	42.87	35.44	cl
-5	0.77	0.74	.48	6.88	6.28	15.15	40.83	44.02	sic/c
-6	0.31	0.34	.26	3.81	5.48	10.20	48.12	41.68	sic
-7	0.37	1.03	.96	2.77	2.19	7.32	43.74	48.94	sic

SOIL PHASE: Cranston gravelly silt loam PROFILE NUMBER: S67-Ky-103-1-

CHEMICAL DATA

Sub No.	Horizon	Depth inches	pH		Base Sat. (%)	meq/100 grams of soil						$CaCO_3$ eq.%3	O.M. (%)	Sol #/A ppm
			H_2O	Salt		CEC	Ca	Mg	K	Na	TEB			
-1	A1	0-5	5.78	4.51	72.79	7.79	3.25	1.02	0.32	0.06	4.67	0.32	3.81	24.0
-2	B1	5-13	4.98	3.75	18.26	4.38	0.40	0.15	0.19	0.06	0.80	0.30	1.31	7.2
-3	B21t	13-23	5.40	3.75	39.43	4.21	0.60	0.81	0.20	0.05	1.66	0.49	0.50	2.0
-4	B22t	23-31	5.40	3.50	34.55	6.31	0.70	1.24	0.18	0.06	2.18	1.16	0.37	1.6
-5	B3t	31-50	5.21	3.50	41.24	6.96	1.00	1.63	0.18	0.06	2.87	0.21	0.22	1.0
-6	C	50-76+	5.53	3.65	69.49	6.62	1.75	2.59	0.20	0.06	4.60	1.87	0.24	1.5

PARTICLE SIZE DISTRIBUTION IN %: Pipette (X), FC Hydrometer ( ), Fractionation( )

Sub No.	VCS 2-1mm	CS 1-.5mm	MS .5-.25	FS .25-.1	VFS .1-.05	Total Sand	Silt .05-002m	Tot.C <.002mm	Textural Class
-1	0.29	0.96	0.77	2.62	19.32	23.96	67.38	8.66	sil
-2	0.38	0.95	0.90	2.80	17.59	22.62	68.65	8.73	sil
-3	0.11	0.97	0.91	3.39	17.42	22.80	68.56	8.64	sil
-4	0.13	0.62	0.57	2.86	15.35	19.53	68.84	11.63	sil
-5	0.10	0.41	0.39	2.79	16.55	20.24	67.00	12.76	sil
-6	0.16	0.41	0.47	2.53	15.64	19.21	67.31	13.48	sil

SOIL PHASE: Dekalb sandy loam **PROFILE NUMBER:** S65-Ky-63-27

CHEMICAL DATA

Sub No.	Horizon	Depth inches	pH H_2O	pH Salt	Base Sat. (%)	meg/100 grams of soil CEC	Ca	Mg	K	Na	TEB	$CaCO_3$ eq.%	O.M. (%)	Sol P #/A ppm
-1	A1	0-2	4.3	3.55	12.2	8.78	0.71	0.12	0.20	0.04	1.07	0.23	5.24	16.1
-2	A2	2-5	4.8	4.20	5.6	4.14	.08	.04	.07	.04	0.23	0.18	1.79	10.5
-3	B1	5-11	4.8	4.30	3.8	3.93	.04	tr.	.05	.06	0.15	0.14	0.70	7.0
-4	B2	11-18	4.2	4.21	11.0	2.28	.16	tr.	.05	.04	0.25	0.14	0.35	4.0
-5	B3	18-25	4.8	4.20	7.0	1.43	.04	tr.	.03	.03	0.10	0.17	0.10	3.5
-6	C	25-35	4.9	3.90	12.7	3.71	.24	.13	.06	.04	0.47	0.22	0.096	3.5
	R	35+ Sandstone rock												

PARTICLE SIZE DISTRIBUTION IN %: Pipette (X) Wells, Hydrometer ( ), Fractionation( )

Sub No.	VCS 2-1mm	CS 1-.5mm	MS .5-.25	FS .25-.1	VFS .1-.05	Total Sand	Silt .05-002m	Tot.C <.002mm	Textural Class
-1	0.08	4.14	40.62	23.94	3.79	72.57	20.65	6.78	sl
-2	.05	4.19	39.53	23.85	3.88	71.50	21.43	7.07	sl
-3	.08	4.00	36.90	23.98	4.16	69.12	24.64	6.24	sl
-4	.10	4.38	39.33	20.84	3.47	68.12	25.98	5.90	sl
-5	.07	7.99	52.35	24.07	3.56	88.04	9.59	2.37	s/ls
-6	.07	9.60	52.78	17.31	3.60	83.36	8.41	8.23	ls

SOIL PHASE: Hartsells sandy loam PROFILE NUMBER: S65-Ky-63-67-

CHEMICAL DATA

Sub No.	Horizon	Depth inches	pH		Base Sat. (%)	meq/100 grams of soil						$CaCO_3$ eq.%	O.M. (%)	Sol P #/A ppm
			H_2O	Salt		CEC	Ca	Mg	K	Na	TEB			
-1	A1	0-3	4.42	3.70	11.1	6.85	0.42	0.02	0.16	0.16	0.76	0.08	4.48	8.0
-2	A2	3-8	4.97	4.14	23.2	2.5	.32	.01	.10	.15	.58	0.09	0.88	3.6
-3	B1	8-14	4.09	3.99	19.3	2.7	.27	.01	.09	.15	.52	0.05	0.48	2.2
-4	B21t	14-22	4.94	3.59	14.7	7.4	.30	.47	.15	.17	1.09	0.07	0.52	1.0
-5	B22t	22-32	5.09	3.51	18.2	9.1	.47	.90	.14	.15	1.66	0.07	0.38	1.0
-6	B3t	32-39	5.10	3.59	14.9	7.6	.35	.47	.15	.16	1.13	0.06	0.26	1.2
	R	39+	Sandstone rock											

PARTICLE SIZE DISTRIBUTION IN %: Pipette (X), Hydrometer ( ), Fractionation( )

Sub No.	VCS 2-1mm	CS 1-.5mm	MS .5-.25	FS .25-.1	VFS .1-.05	Total Sand	Silt .05-002m	Tot.C <.002mm	Textural Class
-1	0.10	0.42	0.50	58.12	9.33	68.47	25.66	5.87	sandy loam (sl)
-2	0.52	0.75	2.70	51.36	8.87	64.20	28.56	7.24	sandy loam (sl)
-3	0.62	0.53	2.47	47.84	8.37	59.83	28.80	11.37	sandy loam (sl)
-4	0.24	0.35	1.82	41.63	7.14	51.18	20.40	28.42	sandy clay loam (scl)
-5	0.17	0.28	1.34	40.33	6.77	48.89	15.72	35.39	sandy clay sandy clay loam (sc/scl)
-6	0.04	0.09	1.09	50.81	7.50	59.53	14.37	26.10	sandy clay loam (scl)

SOIL PHASE: Jefferson sandy loam PROFILE NUMBER: S65-Ky-63-68

CHEMICAL DATA

Sub No.	Horizon	Depth inches	pH H_2O	pH Salt	Base Sat. (%)	meg/100 grams of soil CEC	Ca	Mg	K	Na	TEB	$CaCO_3$ eq.%	O.M. (%)	Sol P #/A ppm
-1	A1	0-2	5.10	4.12	18.75	3.04	0.32	0.08	0.14	0.03	0.57	0.05	2.26	8.5
-2	A2	2-8	5.27	4.01	18.85	2.44	.13	.15	.15	.03	0.46	0.05	0.46	4.8
-3	B1	8-17	5.38	4.23	21.69	1.89	.18	.08	.12	.03	0.41	0.13	0.72	6.0
-4	B2t	17-33	5.10	3.76	15.08	5.37	.10	.44	.22	.05	0.81	0.03	0.36	2.0
-5	B31t	33-43	5.12	3.71	9.49	3.69	.02	.15	.11	.07	0.35	0.03	0.14	1.0
-6	B32t	43-58	4.98	3.60	7.32	4.10	.03	.11	.11	.05	0.30	0.05	0.11	1.5
-7	IIC	58-70+	4.84	3.80	4.20	11.42	-0-	.23	.21	.04	0.48	0.11	0.21	1.0

PARTICLE SIZE DISTRIBUTION IN %: Pipette (X), FC Hydrometer ( ), Fractionation( )

Sub No.	VCS 2-1mm	CS 1-.5mm	MS .5-.25	FS .25-.1	VFS .1-.05	Total Sand	Silt .05-002m	Tot.C <.002mm	Textural Class
-1	1.23	11.54	24.56	36.59	4.72	78.64	16.75	4.61	loamy sand
-2	1.24	10.19	21.40	32.99	4.37	70.19	22.59	7.22	sandy loam
-3	1.28	9.70	22.64	37.29	4.65	75.56	19.18	5.26	ls/sl
-4	1.66	9.44	18.24	30.64	4.51	64.49	19.42	16.09	heavy sandy loam
-5	1.56	7.98	10.62	32.58	7.89	60.63	27.97	11.40	sandy loam
-6	4.18	8.90	12.97	22.32	15.36	63.73	24.18	12.09	sandy loam
-7	0.01	0.78	0.93	1.58	2.22	5.52	54.93	39.55	sicl/sic

SOIL PHASE: Shelocta silt loam PROFILE NUMBER: S67-Ky-88-8-

CHEMICAL DATA

Sub No.	Horizon	Depth inches	pH		Base Sat. (%)	meg/100 grams of soil						$CaCO_3$ eq.%	O.M. (%)	Sol P #/A ppm
			H_2O	Salt		CEC	Ca	Mg	K	Na	TEB			
-1	A1	0-2	5.52	5.43	64.29	10.92	5.75	0.80	0.42	0.05	7.02	0.85	4.97	24
-2	Ap	2-8	4.98	4.70	30.24	8.73	1.90	0.43	0.26	.05	2.64	.57	2.87	14
-3	B1t	8-14	4.70	4.25	40.90	7.31	2.20	0.46	0.28	.05	2.99	.15	.78	2.5
-4	B21t	14-26	4.25	3.75	27.52	7.85	1.15	0.70	0.26	.05	2.16	.55	.29	1.5
-5	B22t	26-36	4.05	3.52	21.57	8.39	0.67	0.84	0.25	.05	1.81	.25	.35	1
-6	B3t	36-47	3.99	3.40	15.42	9.21	0.20	0.92	0.24	.06	1.42	.25	.32	1
-7	C	47-64+	3.80	3.0	16.54	16.38	0.15	2.12	0.37	.07	2.71	.53	.30	1

PARTICLE SIZE DISTRIBUTION IN %: Pipette (X), Hydrometer ( ), Fractionation( )

Sub No.	VCS 2-1mm	CS 1-.5mm	MS .5-.25	FS .25-.1	VFS .1-.05	Total Sand	Silt .05-002m	Tot.C <.002mm	Textural Class
-1	1.36	2.13	1.40	8.01	8.90	21.80	57.75	20.45	sil
-2	1.89	2.58	1.39	8.28	8.77	22.91	55.99	21.10	sil
-3	0.83	1.54	1.02	5.47	7.10	15.96	55.55	28.49	sicl/sil
-4	1.04	2.04	1.17	4.62	6.27	15.14	56.48	28.38	sicl/sil
-5	0.48	1.25	0.87	3.61	5.42	11.63	59.82	28.55	sicl/sil
-6	0.70	1.15	0.68	3.07	4.79	10.39	58.55	31.06	sicl
-7	0.14	0.34	0.21	0.77	1.88	3.34	65.18	31.48	sicl

SOIL PHASE: Talbott silt loam PROFILE NUMBER: S65-Ky-100-84-

CHEMICAL DATA

Sub No.	Horizon	Depth inches	pH H_2O	pH Salt	Base Sat. (%)	meq/100 grams of soil CEC	Ca	Mg	K	Na	TEB	$CaCO_3$ eq.%	O.M. (%)	Sol #/A ppm
-1	Ap	0-5	5.8	4.51	15.8	19.92	2.03	0.75	0.15	0.22	3.15	0.17	3.16	2.7
-2	B1	5-11	5.7	4.43	12.45	17.35	1.57	0.37	.06	.16	2.16	0.16	1.31	1.5
-3	B21	11-18	5.8	4.60	12.28	31.20	2.88	.57	.20	.18	3.83	0.22	1.17	0.5
-4	B22	18-24	6.7	5.50	16.0	31.27	3.67	.73	.36	.25	5.01	1.48	0.98	0.5
-5	B3	24-31	7.3	6.22	15.3	33.12	3.73	.70	.31	.32	5.06	2.75	1.07	0.5
	R	31+ Limestone rock												

PARTICLE SIZE DISTRIBUTION IN %: Pipette (X), Hydrometer ( ), Fractionation( ) Wells

Sub No.	VCS 2-1mm	CS 1-.5mm	MS .5-.25	FS .25-.1	VFS .1-.05	Total Sand	Silt .05-002m	Tot.C <.002mm	Textural Class
-1	1.13	3.68	4.12	8.10	5.50	22.53	49.91	27.56	cl/l/sil
-2	0.58	2.61	2.89	6.05	5.70	17.83	50.06	32.11	sicl
-3	.60	1.20	1.48	3.31	3.13	9.72	34.70	55.58	C
-4	.59	1.14	.99	1.94	1.88	6.54	26.09	67.37	C
-5	.26	0.82	.86	1.98	1.92	5.84	31.56	62.60	C

SOIL PHASE: Wharton silt loam PROFILE NUMBER: S65-Ky-100-63

CHEMICAL DATA

Sub No.	Horizon	Depth inches	pH H_2O	pH KCl Salt	Base Sat. (%)	meg/100 grams of soil CEC	Ca	Mg	K	Na	TEB	$CaCO_3$ eq.%	O.M. (%)	Sol P #/A ppm
-1	A1	0-1	4.8	3.52	19.1	19.13	1.75	.69	.90	.33	3.67	0.14	7.29	9.0
-2	Ap	1-8	4.9	3.70	29.2	9.21	.94	.35	.64	.76	2.69	0.08	2.33	5.3
-3	B1t	8-10	4.7	3.47	26.1	10.49	1.00	.71	.70	.33	2.74	0.04	0.75	1.0
-4	B21t	10-17	4.8	3.33	25.7	14.63	1.62	1.06	.83	.26	3.77	0.07	0.48	0.5
-5	B22t	17-22	4.8	3.31	23.2	17.49	1.88	.94	.90	.35	4.07	0.04	0.41	0.5
-6	B23t	22-26	4.8	3.20	21.6	16.42	1.75	.75	.83	.22	3.55	0.04	0.36	0.5
-7	B3t	26-33	4.8	3.21	27.9	16.20	2.50	.71	.90	.42	4.53	0.06	0.43	0.5
-8	C1	33-39	5.0	3.25	28.3	15.49	2.75	.54	.83	.27	4.39	0.07	0.32	0.5
-9	C2	39-125+	4.7	3.18	34.5	14.13	3.13	.50	.83	.42	4.88	0.05	0.20	0.5

Note: C2 - relict shale structure very hard to dig with orchard auger.

PARTICLE SIZE DISTRIBUTION in %: Pipette (X) FC Hydrometer ( ), Fractionation ( )

Sub No.	VCS 2-1mm	CS 1-.5mm	MS .5-.25	FS .25-.1	VFS .1-.05	Total Sand	Silt .05-002m	Tot. C <.002mm	Textural Class
-1	2.65	1.66	0.80	2.61	13.86	21.58	65.71	12.71	sil
-2	2.31	1.54	0.65	2.14	13.13	19.77	68.87	11.36	sil
-3	1.13	1.11	0.67	1.75	8.13	12.79	54.12	33.09	sicl
-4	0.26	0.49	0.30	0.95	5.14	7.14	45.79	47.07	sic
-5	0.47	0.57	0.49	1.19	3.19	5.91	44.06	50.03	sic
-6	0.20	0.37	0.23	0.54	1.99	3.33	40.46	56.21	sic/c
-7	0.58	0.73	0.31	0.69	2.37	4.68	39.94	55.38	c/sic
-8	4.33	2.05	0.75	1.32	3.32	11.77	35.73	52.50	c
-9	1.19	1.14	0.45	1.17	2.95	6.90	48.86	44.24	sic

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Glossary

Acidity. See Reaction.

Alluvium. Sand, silt, clay and gravel washed from upland soils, carried by streams, and deposited on floodplains or terraces.

Aspect. The direction toward which a hill slope faces.

Available Moisture Capacity. Soil moisture that can be readily absorbed by plant roots. The water held in the soil up to a pressure of 15 bars.

Bedrock. The geologic formation underlying the soil profile that has not been greatly weathered. There are four kinds in the survey area: Sandstone, shale, siltstone and limestone.

Bench. A narrow, step-like protusion from a hillside that is not as steep as the surrounding hillside and that parallels the contour.

Bottom land. Flood plain.

Coarse Fragments. Fragments of rock in or on the soil that are larger than 2 millimeters.

Clay. Mineral particles less than 0.002 mm in diameter.

Colluvium. A deposit of rock fragments and soil material accumulated on steep sideslopes, toeslopes, and benches as a result of gravitational action.

Color, soil. Soil color is determined by the Munsell Soil Color Charts which display 196 different standard color chips systematically arranged by Hue, Value and Chroma on seven charts.

Consistence. The resistance of soil material to crushing. Or the degree of cohesion or adhesion of the soil mass. Terms used in this report are:

- Friable. Moist soil that crushes easily under gentle to moderate pressure. Most surface layers are friable.
- Firm. Moist soil that crushes under moderate pressure, but resistance is distinctly noticeable.
- Hard. Dry soil that resists pressure and can be crushed with difficulty.
- Loose. Noncoherent; will not hold together in a mass. Generally coarse textured soils.
- Plastic. Wet soil that forms a wire when rolled between thumb and forefinger. Moderate pressure is required to deform the mass.
- Sticky. Wet soil that after pressure adheres to both thumb and forefinger and tends to stretch when digits are separated.

Drainage, natural. This is natural drainage which reflects the conditions that existed during the development of the soil.
Somewhat Excessively and excessively drained. Commonly porous and very permeable soils that are free of mottling and have a low water-holding capacity.
Well drained. Soils nearly free from mottling and are commonly of intermediate texture.
Moderately Well Drained. These soils commonly have a slowly permeable layer in the subsoil. They are mottled in the lower part of the subsoil and the C horizon.
Somewhat poorly drained. Soils are wet for significant periods and are mottled below 6 inches in the A, B and C horizons.
Poorly drained. These soils are wet for long periods and are light gray and often mottled from the surface downward.

Flood plain. The land bordering a stream, built up of sediments from overflow of the stream and subject to inundation when the stream is at flood stage.

Fragipan. A subsurface horizon with high bulk density relative to the layers above, seemingly cemented when dry, but when moist showing a moderate to weak brittleness. The layer is low in organic matter, mottled, and slowly or very slowly permeable to water.

Horizon, soil. A layer of soil, approximately parallel to the surface that has distinct characteristics produced by soil-forming processes. Each horizon in a profile has different physical and chemical characteristics. A set of genetically related horizons make up a soil profile.

Impervious. Resistant to the penetration of roots or water.

Infiltration. The downward entry of water into the soil.

Mottling. Spots or blotches of different color interspersed with the dominant color. Usually an indication of poor drainage or poor aeration.

Particle-size analysis. Determination of the various amounts of the different separates in a soil sample, usually by sedimentation and sieving.

Permeability, soil. The quality that enables water or air to move through the soil. The horizon in a profile with the slowest inches per hour rate determines the permeability for the whole soil. See the Water and Engineering sections.

Profile, soil. A vertical section of the soil through all its horizons and extending to bedrock or well into the C horizon.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values or words.

	pH		pH
Extremely acid	below 4.5	Medium acid	5.6 to 6.0
Very strongly acid	4.5 to 5.0	Slightly acid	6.1 to 6.5
Strongly acid	5.1 to 5.5	Neutral	6.6 to 7.3
		Mildly alkaline	7.4 to 7.8

Residuum. Unconsolidated, partly weathered mineral material that accumulates, in place, over disintegrating rock. Soils on ridgetops generally develop in residual materials.

Sand. Soil particles between 0.05 and 2.0 mm in diameter. There are five size class of sand. See Laboratory Data, Section H.

Silt. Soil particles between 0.05 and 0.002 mm in diameter.

Structure, soil. The arrangement of sand, silt and clay into peds or aggregates. The peds are usually arranged in a distinctive pattern in the profile and they are classified and described on the basis of size, shape, and degree of distinctness or grade.

(a) Granular - spheroidal and relatively nonporous. Fine is 1.0 to 2.0 mm, medium 2.0 to 5.0 mm, and coarse to 5 to 10 mm.

(b) Blocky - blocks having plane or curved surfaces that are casts of the molds formed by the faces of the surrounding peds. Very fine is less than 5.0 mm, fine is 5.0 to 10 mm, medium is 10 to 20 mm, and coarse is 20 to 50 mm. Subangular blocky has mixed rounded and flattened faces. Angular blocky has flattened faces that are sharply angular.

(c) Structureless. Lacks peds or aggregates.
Single grain - Sandy layers, each grain by itself.
Massive - Clayey layers, particles stuck together with no cleavage planes.

Subsoil. Technically, the B horizon; roughly, the part of the profile below plow depth.

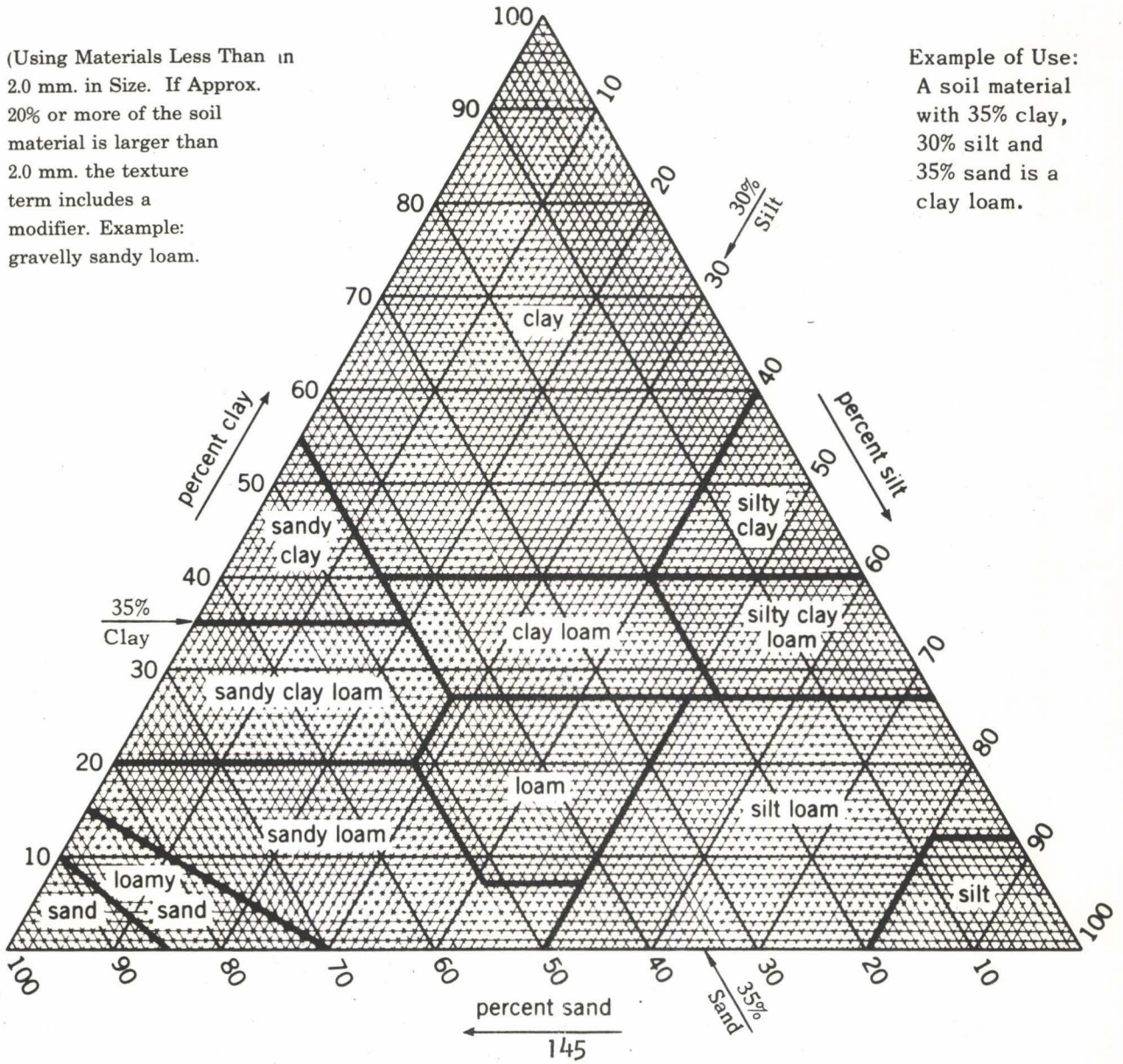
Surface, soil. The uppermost part of the soil ranging in depth from 3 or 4 inches to 8 or 10. Technically the A horizon.

Terrace. An old flood plain, either flat or undulating, bordering a stream or river and usually at different levels. Low terraces or second bottoms set immediately above the current flood plain and are occasionally subject to flooding. High terraces generally set above a steep slope and rarely, if ever, flood.

Texture, soil. The relative proportions of the various soil particles (sand, silt, clay) and described as a textural class. Below is a graph showing the percentages of the different particles in the soil classes.

GUIDE FOR USDA SOIL TEXTURAL CLASSIFICATION.

(Using Materials Less Than in 2.0 mm. in Size. If Approx. 20% or more of the soil material is larger than 2.0 mm. the texture term includes a modifier. Example: gravelly sandy loam.



Example of Use: A soil material with 35% clay, 30% silt and 35% sand is a clay loam.

Table 15 List of Mapping Unit Symbols and Names with Functional Management Groups

Soil Survey Legend							
Map Symbol	Soil Phase Name	Timber	Water	Hydrologic Soil Unit	Recreation	Wildlife	Agronomic
376B1	Allegheny loam, 2 to 6 percent slopes	2	3	RDG	8	7	9
376C1	Allegheny loam, 6 to 12 percent slopes	2	3	RDG	8	7	9
376D1	Allegheny loam, 12 to 20 percent slopes	2	3	RDM	3	7	9
878G1	Berks silt loam, 50 to 70 percent slopes	11	15	RM_xV	1	1	2
191	Bonnie silt loam	1	1	SSwG	2	2	6
444F1; 723E1, F1, G1	Brookside stony silt loam, 30 to 60 percent slopes	8	14	SD_xS	1	9	11
793C1; 725D1, D3	Jefferson-Caneyville sandy loam, 6 to 20 percent slopes	2	6	MD_xM-SMM	3	7	9
793E1; 725E1, E3	Jefferson-Caneyville stony sandy loams, 20 to 30 percent slopes	9	6	MD_xM -SMM	1	9	12
793F1; 725F1	Jefferson-Caneyville stony sandy loams, 30 to 60 percent slopes	9	13	MD_xS-SMS	1	9	12
380A1	Chavies fine sandy loam, 0 to 2 percent slopes	2	3	RVG	11	3	4
380B1	Chavies fine sandy loam, 2 to 6 percent slopes	2	3	RVG	10	3	4
133; 283	Clifty silt loam	2	2	RD_wG	9	10	4
46B1, 47B1	Cotaco loam, 2 to 6 percent slopes	1	1	MM_wG	5	6	3
490B1; 40B1	Cranston gravelly silt loam, 2 to 6 percent slopes	2	3	RDG	10	3	1
490C1; 40C1	Cranston gravelly silt loam, 6 to 12 percent slopes	2	3	RDG	8	7	1
490D1; 40D1; 842D3	Cranston gravelly silt loam, 12 to 20 percent slopes	2	3	RDM	3	7	1
490E1; 842E1	Cranston gravelly silt loam, 20 to 30 percent slopes	10	9	MD_xM	1	8	13
490F1; 842F1	Cranston gravelly silt loam, 30 to 60 percent slopes	10	9	MD_xS	1	8	13
180; 187	Cuba silt loam	2	2	RD_wG	9	10	7
857C1; 836C1	Dekalb fine sandy loam, 6 to 12 percent slopes	11	10	RMG	12	4	5
857D1; 836D1; 011	Dekalb and Ramsey rocky fine sandy loams, 6 to 20 percent slopes	11	11	RMM	1	4	2
857E1	Dekalb and Ramsey rocky fine sandy loams, 20 to 40 percent slopes	11	11	RMS	1	4	2
379A1; 377A1	Elk silt loam, 0 to 2 percent slopes	2	3	RVG	11	3	7
379B1; 377B1	Elk silt loam, 2 to 6 percent slopes	2	3	RVG	10	3	7
377C1	Elk silt loam, 6 to 12 percent slopes	2	3	RVG	8	7	1
864B1,C1; 80C1	Gilpin silt loam, 6 to 12 percent slopes	4	12	MM_xG	7	5	5
864D1;80D1,864D3	Gilpin silt loam, 12 to 20 percent slopes	4	12	MM_xM	4	12	5
805B1, C1	Hartsells fine sandy loam, 2 to 12 percent slopes	4	10	RMG	12	5	5
805D1	Hartsells fine sandy loam, 2 to 12 percent slopes	4	11	RMM	4	4	2
41B1; 44B1	Jefferson gravelly loam, 2 to 6 percent slopes	2	3	RDG	10	3	9
41C1; 44C1	Jefferson gravelly loam, 6 to 12 percent slopes	2	3	RDG	8	7	9
41D1	Jefferson gravelly loam, 12 to 20 percent slopes	2	3	RD_xM	3	7	9
41E1	Jefferson gravelly loam, 20 to 30 percent slopes	9	13	RD_xM	1	9	13
41F1	Jefferson gravelly loam, 30 to 50 percent slopes	9	13	RD_xS	1	9	13
43F1; 492F1	Jefferson stony sandy loam, 30 to 60 percent slopes	9	13	RD_xS	1	9	12
387A	Johnsburg silt loam	1	4	SM_pG	5	6	6
383B1	Monongahela fine sandy loam, 2 to 6 percent slopes	3	4	SM_pG	6	7	8
383C1	Monongahela fine sandy loam, 6 to 12 percent slopes	3	4	SM_pG	6	7	8
480	Morehead silt loam	1	1	MM_wG	5	6	3
332B1	Muse silt loam, 2 to 6 percent slopes	2	3	MVG	10	3	9
332C1	Muse silt loam, 6 to 12 percent slopes	2	3	SDG	8	7	9
332D1	Muse silt loam, 12 to 20 percent slopes	5	8	SDM	3	7	10
332E1	Muse silt loam, 20 to 30 percent slopes	6	8	SDM	1	8	13
813F1	Muse-Trappist stony silt loam, 30 to 60 percent slopes	6	14	SD_xS-SM_xS	1	8	2

Table 15 List of Mapping Unit Symbols and Names with Functional Management Groups, Cont'd.

Soil Survey Legend							
Map Symbol	Soil Phase Name	Timber	Water	Hydrologic Soil Unit	Recreation	Wildlife	Agronomic
181A; 116A	Pope fine sandy loam	2	2	RD_wG	9	10	4
181A2; 10A,C; 16A,C	Pope fine sandy loam, non acid	2	2	RD_wG	9	10	4
297	Pope gravelly fine sandy loam	2	2	RD_wG	9	10	4
237	Pope gravelly fine sandy loam, non acid	2	2	RD_wG	9	10	4
339B1	Renox gravelly silt loam, 2 to 6 percent slopes	2	3	RDG	10	3	9
335B1	Renox gravelly fine sandy loam, 2 to 6 percent slopes	2	3	RDG	10	3	9
335C1,D1	Renox gravelly fine sandy loam, 6 to 15 percent slopes	2	3	RDG	8	7	9
390	Robertsville silt loam	1	1	SS_wG	2	2	6
438D1	Wharton-Shelocta silt loams, 12 to 20 percent slopes	5	8	SD_xM	3	7	10
438E1;80E1,E3;864E1; 81E1,E3; 883E1	Wharton-Shelocta silt loams, 20 to 30 percent slopes	6	8	SD_xM	1	8	13
438F1;840F1,F3; 867F1; 840G1;883F1	Wharton-Shelocta silt loams, 30 to 50 percent slopes	6	14	SD_xS	1	8	13
112	Shoals fine sandy loam	1	1	SS_wG	2	6	3
185	Stendal fine sandy loam	1	1	MS_wG	5	6	3
286	Stendal gravelly fine sandy loam	1	1	MS_wG	5	6	3
184	Stendal silt loam	1	1	MS_wG	5	6	3
043	Strip mines						14
707C1;704C1;725C1,C2,D2	Talbott very rocky silt loam, 6 to 20 percent slopes	7	5	SMM	1	11	11
707E1	Talbott very rocky silt loam, 20 to 40 percent slopes	7	5	SMM	1	11	11
86B1	Tilsit silt loam, 2 to 6 percent slopes	3	4	SM_pG	6	7	8
86C1	Tilsit silt loam, 6 to 12 percent slopes	3	4	SM_pG	6	7	8
892C1;882C1;803C1;825C1	Wharton silt loam, 6 to 12 percent slopes	5	7	SM_xG	7	12	10
892D1,D3;882D1;803D1; 825D1;821D1,D3	Wharton silt loam, 12 to 20 percent slopes	5	8	SM_xM	4	12	10
892E1; 882E1	Wharton silt loam, 20 to 30 percent slopes	6	8	SM_xM	1	8	13
83C1,B1	Whitley silt loam, 6 to 12 percent slopes	4	12	MM_xG	7	12	5
83D1	Whitley silt loam, 12 to 20 percent slopes	4	12	MM_xM	4	12	5

APPENDIX A. SPECIAL SYMBOLS USED ON FIELD MAPS

BOUNDARIES AND MARKERS SYMBOLS (black unless noted)

Soil Boundary and Symbol---------- 892D1

County Line----------

Photo Match Line---------- Green

Survey Area Boundary----------

National Forest Line----------

TRANSPORTATION AND TRANSMISSION SYMBOLS (all black)

Roads: State Route (32) Federal Route 60 Interstate 64 or I-64

Hard Surfaced----------

Improved Gravel----------

Dirt Road or Private----------

Trail----------

Bridges----------

Railroad----------

Power Line-Trunk Line Only----------

Towers (fire)----------

Pipeline----------

SPECIAL SOIL SYMBOLS (black unless noted otherwise)

Severe Eroded or Gullied Land---------- red

Bedrock Escarpment----------
(Where escarpment or cliff is the soil boundary.) Soil boundary line

Boulders and Stones----------

Rock Outcrop----------
(Includes intermittent cliffs that are not soil boundaries.)

GENERAL SYMBOLS (all black)

Quarry---------- 1 acre or less -

Buildings (houses)---------- occupied --

vacant --

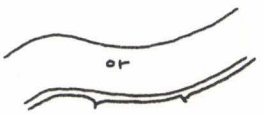
Church----------

School----------

Cemetery---------- or

Sinkholes----------

HYDROGRAPHIC SYMBOLS (blue)

Perennial Stream---------- 

Intermittent Stream----------

Reservoir----------

Ponds----------

Termination of Stream on
Floodplain or in Sinkhole----------

Wet Spot---------- 1 acre or less --

Appendixes B and C

U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
EDWARD P. CLIFF, CHIEF

DANIEL BOONE NATIONAL FOREST

(NORTH HALF)

KENTUCKY

1964

Scale
1 0 1 2 3 4 5 Miles

LEGEND

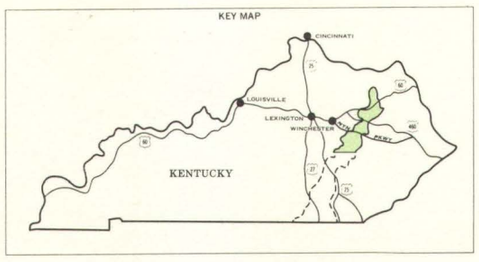
- National Forest Boundary
- Interstate Highway
- U.S. Highway
- State Highway
- Forest Route
- Divided Highway
- Paved Road
- All Weather Road
- Dirt Road
- Primitive Road
- Trail
- Highway Interchange
- Railroad
- Railroad Tunnel
- Forest Supervisor's Headquarters
- Ranger Station
- Recreation Site
- Recreation Site, Other Than Forest Service
- Mine, Quarry or Gravel Pit
- Permanent Lookout Station
- House, Cabin, or other Building
- National Forest Land

Note: The National Forest Boundary is portrayed in true location on this map except where coincident with natural or cultural features. In the latter situations, the boundary symbol has been displaced sufficiently to preserve the feature symbolization.

FOREST SERVICE MAP CLASS A
Compiled at Regional Office, Upper Darby, Pennsylvania, 1963-64,
from U.S. Geological Survey Quadrangles. Field Edited by U.S. Forest Service, 1963-64

Polyconic Projection
1927 North American Datum

KEY MAP



APPENDIX C SOIL MANAGEMENT AREA MAP

Refer to the descriptions and diagrams in
Section A Part III of this Report

Soil Management Areas — Soil-Geology-Landscape units for broad management.

1. Cranston-Berks Soil Management Area. Deep and moderately deep soils on smooth steep and very steep sideslopes and very narrow ridgetops. Mississippian Age acid siltstone and shale.
2. Jefferson-Brookside-Dekalb Soil Management Area. Deep and moderately deep soils on stony and benchy steep sideslopes with sandstone and limestone cliffs. Mississippian Age limestone shale and siltstone mostly and Pennsylvanian Age sandstone and shale on the upper part of the slope.
3. Tilsit-Elk-Clifty Soil Management Area. Deep soils on terraces, second bottoms and floodplains. Soils developed in alluvium deposited over siltstone and some shale.
4. Wharton-Shelocta Soil Management Area. Moderately deep and deep silty soils on short steep sideslopes and mostly narrow ridges. Pennsylvanian Age acid shale and siltstone. Mississippian Age in Bath County.
5. Berks-Cranston-Wharton Soil Management Area. Moderately deep and deep silty soils on steep and very steep smooth sideslopes and moderately wide ridges. Mississippian Age acid siltstone and shale. Some limestone caps.
6. Jefferson-Cranston-Dekalb Soil Management Area. Deep and moderately deep stony soils on steep benchy sideslopes below a spectacular sandstone cliff. Dominated by Pennsylvanian Age sandstone, Pottsville Escarpment, but lower slopes west of the escarpment are Mississippian Age siltstone and shale with some limestone.
7. Tilsit-Wharton-Johnsburg Soil Management Area. Deep and moderately deep silty soils on gently sloping to moderately steep high terraces and knobs. Soils developed in alluvium and acid shale. Areas are underlain by Mississippian Age acid siltstone and shale.
8. Talbott-Wharton Soil Management Area. Moderately deep clayey soils on broad ridges and knobs. Mississippian Age limestone and shale. Some caps of Pennsylvania Age acid sandstone and shale.
9. Shelocta-Jefferson-Wharton Soil Management Area. Deep and moderately deep soils on steep stony and benchy sideslopes below a cliff and moderately wide ridges. Pennsylvanian Age acid sandstone and shale.

U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
EDWARD P. CLIFF, CHIEF

DANIEL BOONE NATIONAL FOREST

(NORTH HALF)

KENTUCKY

1964

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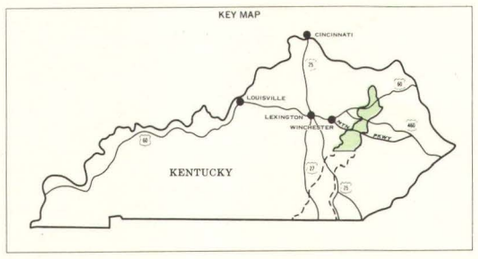

APPENDIX B. Index to Soils Maps Note that each county has a separate numbering system. Soil Maps are filed by County at the Ranger Districts and at the Supervisors Office.

Complete sets of soil maps are not on file for Powell, Wolfe, Lee and Estill Counties. For soil maps needed but not on file, write State Soil Scientist, 1409 Forbes Road, Lexington, Kentucky.

84°10′ 84°00′ 50′ 40′ 30′ 83°20′ 38°20′ 10′ 38°00′ 50′ 37°40′